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The Seattle Fireboat Duwamish

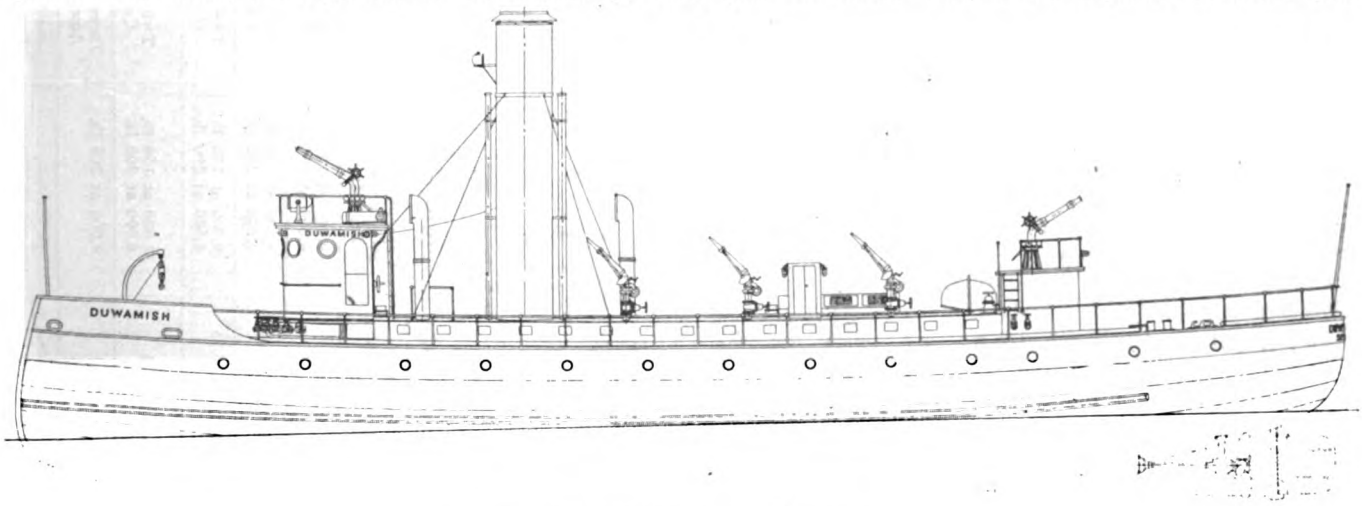
By H. Cole Estep.

POSSIBLY as much interest, from an engineering standpoint, attaches to the design of a fireboat as to any other type of vessel produced in the modern ship yard. A successful fireboat involves a nice combination of the principles of naval architecture and of marine, mechanical and hydraulic engineering and represents a discriminating compromise between many demands, of which the chief are a seaworthy, fast, readily maneuvered hull, ample boiler capacity, and above all a reliable, powerful, high-pressure, pumping equipment.

A fireboat and a naval vessel are alike in that their machinery and mechanical equipment are of first importance; on the mechanical department the designer concentrates his best thought. A fire boat must be ready to leave her berth at any time and get quickly to the scene of the conflagration; when there she must be ready to deliver a large volume of water at high pressure continuously for many hours, or even days, if necessary. To insure success in these vital particulars great care must be bestowed on the design and installation of machinery, every part of which should not only be able to perform its own functions well, but should work in harmony with the other parts.

In recent years a number of new and powerful fireboats have been built to protect floating and harbor property in the cities of Chicago, New York and San Francisco, and for the Duluth, Mesaba & Northern railroad, at Duluth. Somewhat over a year ago the city of Seattle, on Puget sound, awoke to the fact that a modern fireboat was needed to replace the old wooden fire tug, Snoqualmie, which is of inferior capacity. McAllaster & Bennett, naval architects, Seattle, were commissioned to design the new boat, and the steel, twin-screw steamer, Duwamish, recently placed in commission, is the result.

In one important particular the Duwamish is a departure from the general tendency observed in recent fireboat designs. In each of the seven boats built in the past two years for San Francisco, Duluth, Chicago and New York, two-stage centrifugal fire pumps direct-connected to steam turbines were installed, but in the Seattle boat reciprocating pumps were furnished. It will be noted that the normal working pressure of the turbo-pump boats, with pumps working in parallel, that is to say delivering into



Outboard Profile Fireboat Duwamish.

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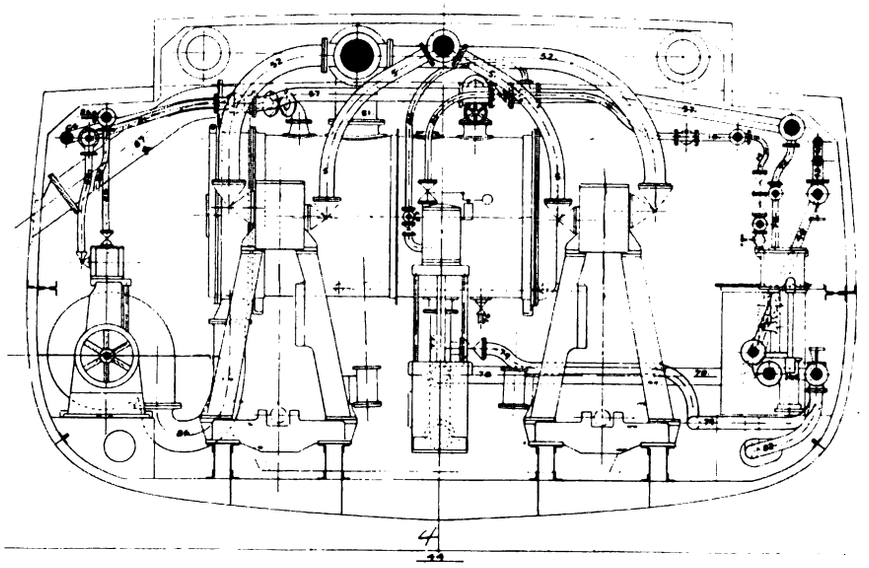
a common discharge, is 150 lb., while by working in series, one pump delivering into the suction of another, the pressure is doubled and the quantity cut in half. The Seattle boat, however, is designed for 9,000 gal. at 200 lb. pressure, and is thus the equal in pump duty of the Duluth boat, although the latter has the largest volumetric capacity of any fireboat in the world. In order to readily compare the Chicago, Duluth, San Francisco, New York and Seattle fireboats, Table 1 gives the principal features of each.

Since the design of every fireboat is an individual problem controlled largely by local conditions, the following information bearing on the service which the Duwamish will be expected to give, is inserted: Seattle is a city of 310,000 population, situated on Elliott bay, a well-protected body of salt water of ample depth and sea room. There is no auxiliary system of salt water fire mains through which the fireboat might be required to pump, although the Duwamish has been equipped to pump into auxiliary mains should any be constructed in the future. The boat is of use only when fires occur in the immediate vicinity of the water front where the flames can be reached from the fire tug's monitors or by means of hose lines.

The shore line of Seattle harbor, including dredged waterways, is 20 miles in length. About 10 miles of this is closely built up with wooden piers and docks of very inflammable construction and the remaining 10 miles is improved by scattering structures. The fireboat station is at the foot of Madison street; the distance between the fire station and the farthest docks on Elliott bay proper is 3 miles; the most important of the shipping and harbor property, however, are within a third of a mile of the station. In addition, there are several large saw mills and other lumbering manufacturing plants on Salmon bay in the northern part of Seattle, which are dependent to an appreciable extent on the fireboat for protection and to reach these mills from the Madison street station a trip of 11 miles is necessary. It will be seen that the conditions require a boat of good capacity, with fair speed, capable of coping with such fires as may break out in a closely built, timber constructed water front crowded with traffic.



SECTION AT ENGINE ROOM FIREBOAT DUWAMISH LOOKING AFT.

The principal dimensions of the Duwamish are as follows:

	Feet.	Inches
Length, l. w. l.	115	10½
Length, over all	120	0
Beam, molded	28	0
Beam on deck, molded	26	10
Depth, molded	15	0
Displacement at 7 ft., 11 in. draught	450 net tons.	

The hull is single-decked, with orlop decks forward and aft. There is no cabin, but a trunk for ventilation and the convenient arrangement of piping is built from frame 18 to frame 49, with a steel pilot house forward, fitted with round deadlights. Access to the hold may be had through seven scuttles located at various points on the deck. There are two smokestacks set abreast and situated just abaft the pilot house. The topsides of the hull are tumbled home 7 in. to prevent contact between the sheer line and the dock alongside under any probable conditions of trim or approach to dock. The forefoot and stern are cut away to give the great-

TABLE I.—COMPARISON OF PRINCIPAL FEATURES OF RECENT FIREBOATS.

Owner.	Name of Boats.	Dimensions. Length, Beam, Depth.	Capacity of Fire Pumps. Gallons Per Minute.	Number and Type of Pumps.	Propelling Engines.	No. of Screws.	Speed. Miles Per Hour.	Boilers and Total Heating Surface.
City of Chicago	Joseph Medill	120x28x15	9,000 at 150 lb. 4,500 at 300 lb.	Two 2-stage turbo. Curtis turbines.	Two 250 H. P. electric motors.	Twin	12.0	2 Scotch, 11'6"x12'6", 3,820 sq. ft.
City of Chicago	Graeme Stewart							
City of San Francisco	David Scannel	129x26x12.75	9,000 at 150 lb. 4,500 at 300 lb.	Two 2-stage turbo. Curtis turbines.	2-cyl. simple.	Twin	.....	2 water tube, 5,520 sq. ft.
City of San Francisco	Dennis T. Sullivan							
City of New York	Thos. Willett	131x27x14.75	9,000 at 150 lb. 4,500 at 300 lb.	Two 2-stage turbo. Curtis turbines.	Compound 18" and 28"x36".	Single	15.0	2 water tube, 4,500 sq. ft.
City of New York	Jesse Duane							
Duluth, Mesaba & Northern R. R.	Wm. A. McGonagle	120x28x15	12,000 at 150 lb. 6,000 at 300 lb.	Two 2-stage turbo. Curtis turbines.	2-cyl. simple non-condensing, 20"x24".	Single	15.0	2 Scotch, 13'9"x11'6", 5,000 sq. ft.
City of Seattle	Duwamish	120x28x15	9,000 at 200 lb.	Three reciprocating, American-LaFrance.	2-cyl. simple condensing, 14"x16"	Twin	14.0	4 water tube, 9,000 sq. ft.
Duluth & Iron Range R. R.	Building (Duplicate of W. A. McGonagle)	120x28x15	12,000 at 150 lb. 6,000 at 300 lb.	Two 2-stage turbo. Curtis turbines.	2-cyl. simple non-condensing, 20"x24".	Single	14.0	2 Scotch, 13'9"x11'6", 5,000 sq. ft.

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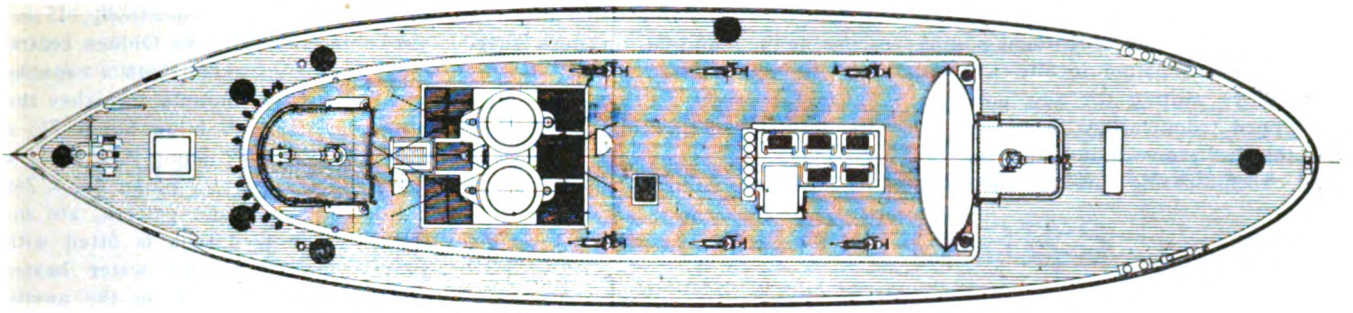
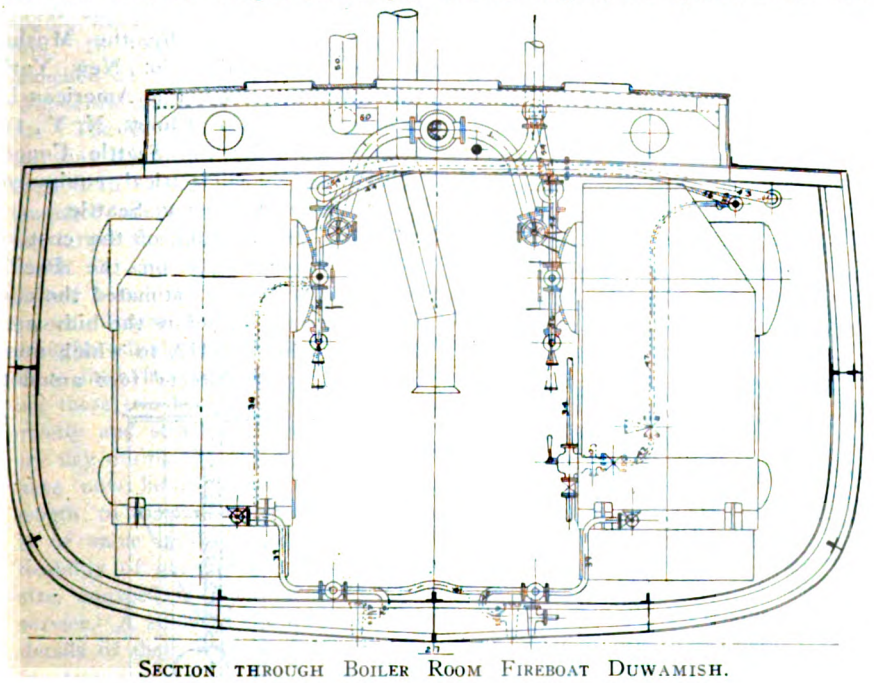


DECK PLAN FIREBOAT DUWAMISH.

est practicable handiness. The bounding lines of the hull are all convex fore and aft to make it possible to spring off the dock under any conditions. The stem rakes aft as the result of the tumble-home sides and the stern is modeled of the compromise torpedo boat type, with a parabolic deck line of short radius to give increased water line length, simple construction and maximum available space in after compartments, with adequate protection for the twin propellers.

The keel is built of 30-in. 20-lb. flat plates for half the length amidships, reduced to 15-lb. at ends. The plates are single butt strapped and double riveted. The stem is forged 6 x 1½ in. and the rudder post 6 x 3 in. in section.

The main frames are 3½ x 3 x 7.9 lb. angles spaced 22 inches and continuous from center keelson to deck stringer. Thirty doubling bars the same size as the main frame angles are riveted over the keel. At the bulkheads, partial bulkheads and webs the main frames are doubled, using 3 x 3 x 7.2 lb. angles. Stern cant frames are 3 x 3 x 7.2 lb. angles.



SECTION THROUGH BOILER ROOM FIREBOAT DUWAMISH.

Reverse frames, 2½ x 2½ x 5 lb. angles, are carried alternately to deck stringer and to side stringer. Web frame plates are 12 in. wide, 14 lb.; continuous through the side stringers.

For half length amidship the floors are built of 16-in., 15-lb. plate, continuous from bilge to bilge, reduced to 12½-lb. forward and aft.

The center keelson, side keelsons and bilge stringers are intercostal plates tied to the neighboring frame members with angles.

The main deck beams, 6 x 3½ x 13.5 lb. angles, are spaced 22-in. centers amidships and 44-in. centers at ends; there are two strong beams on frames 26 and 41 each built of two, 6 x 3½ x 3½ x 15-lb. channels placed back to back.

The shell plating is as follows:

	Pounds.
Garboards, all fore and aft	15.0
Bilge strakes, for half length amidship	15.0
Bilge strakes, at ends	12.5
Bottom and side strakes, half length amidship	14.0
Bottom and side strakes, at ends	12.5
Topside strake, all fore and aft	12.5
Sheer strake, half length amidship 36 in. wide	18.0
Sheer strake, at ends	15.0

The stern tubes are cast iron with brass sleeves carrying lignum vitae bearings at each end of the tube.

The hull is divided into five water tight compartments by four water tight bulkheads. The bulkheads are all solid without doors or hatches except that between the engine and boiler rooms, which is fitted with water tight door.

The main deck is 3½ x 3 in. fir, fastened by ½ in. galvanized deck screws.

The four boilers are situated forward, arranged in two banks facing athwartship; immediately aft of the boilers are situated the three vertical, reciprocating fire pumps, set athwartship. Aft of the fire pumps are two propelling engines, and at the extreme rear end of the engine room is the surface condenser arranged with its axis athwartship. The various minor auxiliaries are placed on either side of the main engines.

The boilers are of the Mosher water tube type, each having 2,250 sq. ft. of heating surface, built by the Mosher Water Tube Boiler Co., New York, and worked with natural draft. The working steam pressure is 175 lbs. per sq. in. Crude oil is used for fuel, the oil being supplied to the furnaces through 16 Lassoe-Lovekin steam-atomized burners. The fuel oil is carried in one tank of 11,634 gallons capacity located in the forehold forward of the fire room bulkhead.

Reciprocating fire pumps were adopted instead of centrifugal pumps, such as have been installed in all of the recently built fire boats, for a number of reasons. It is said that the corrosive action of the salt water of Elliot Bay, which is contaminated with sewage acids near the shore, is very severe and that centrifugal pumps fitted with brass runners and cast iron cases would require extensive repairs from time to time. The conclusions regarding the corrosion of the pumps are based on the experience of Seattle contractors who have used turbine pumps with salt water extensively. It is further claimed that the reciprocat-

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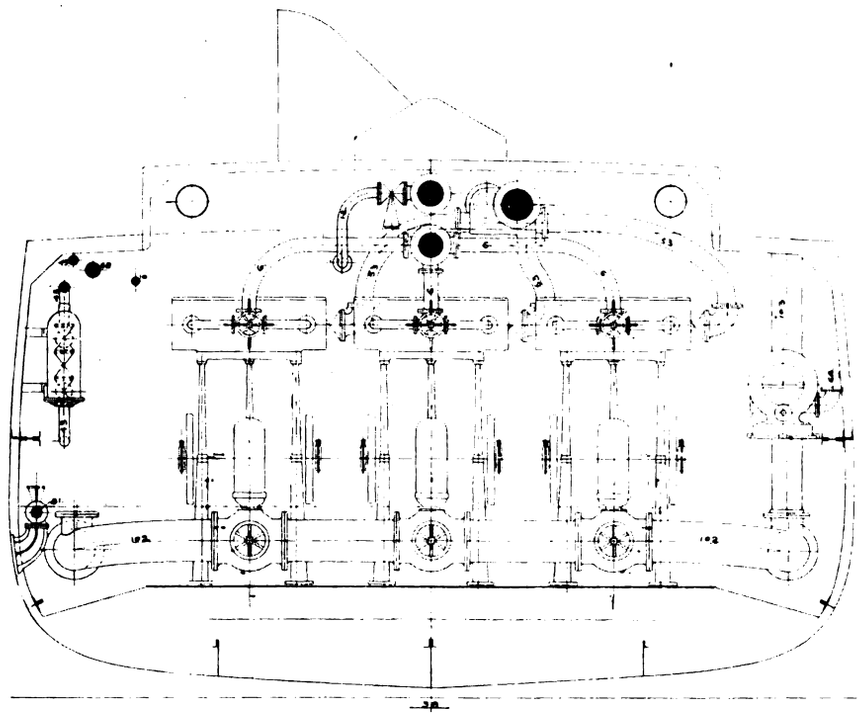
ing pumps, delivered in Seattle, are cheaper and that the centrifugal pumps could not be repaired locally without long delays waiting for new parts to be shipped from eastern factories.

With the above considerations in mind, reciprocating pumps built by the American-La France Fire Engine Co. were selected. Three complete sets were installed, each set consisting of two simple, double-acting, vertical, crank and fly pumps with a capacity of 3,000 gallons per minute against 200 lbs. pressure, with a steam pressure of not less than 150 lbs. per sq. in. The steam cylinders are 17 in. diameter, 11 in. stroke, fitted with piston valves. The pump cylinders are 10 in. in diameter, 11 in. stroke. The pump bodies, valve chambers and all parts in contact with water are made of composition, and all bolts, nuts and studs about the pumps are of phosphor bronze and the pump piston rods are Tobin bronze. The valve areas are 80 per cent and 60 per cent of the pump piston area for suction and discharge respectively. All piping immediately connected with the pumps is copper, the two main suctions being each 16 in. in diameter with an emergency suction of cast iron 12 in. in diameter. The suction valves lead to the sea just below the turn of the bilge. Each pump discharges through a 10-in. tee valve into 14-in. mains. On deck under the pilot house is a cast iron hose manifold provided with 12 flanged openings fitted with 3½-in. hose valves.



SECTION AT ENGINE ROOM FIREBOAT DUWAMISH LOOKING FORWARD.

Two 12-in. mains are led aft terminating in a manifold on deck fitted with four 3½-in. hose valves.

There are eight fire monitors, fitted with adjustable tips and controlling apparatus. Six small monitors with 2-in. tips are arranged on the trunk amidships, three on each side. Mounted on the pilot house is a large monitor fitted with 4, 4½ and 5½-in. removable nozzle tips and on an elevated platform aft is another monitor similar in design fitted with 3, 3½ and 4-in. tips. The two large monitors were manufactured by the American-La France Fire Engine Co.; the six smaller ones were furnished by the Seattle fire department.

The propelling engines are of the simple two-cylinder type with 14 x 16-in. cylinders driving 4-bladed outward-turning propellers 6 ft. diameter, 8 ft. pitch, having cast iron hubs and bronze blades. The two cylinders and their valve chests are cast in one piece; and the valves, which are of piston type, operated by the usual link motion, take steam at the center and exhaust over the ends. A steam reversing gear is fitted.

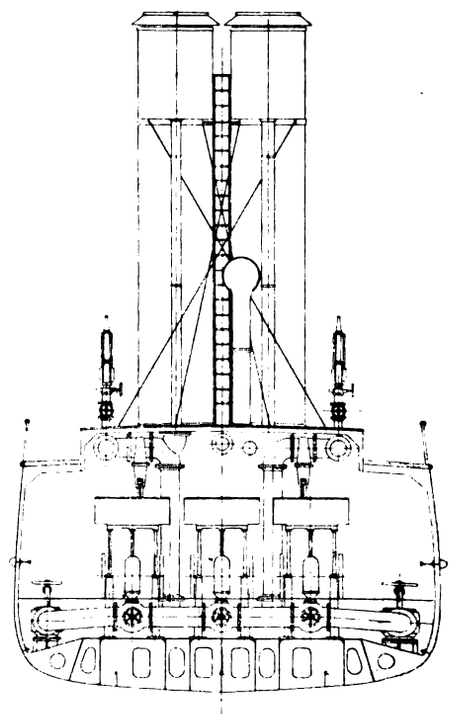
Both the fire pumps and propelling engines exhaust normally into a common surface condenser. There is also fitted an emergency exhaust to the atmosphere. The condenser has a cooling surface of 4,200 sq. ft.; with ¾-in. seamless drawn brass tubes, tinned inside and outside. An independent, single-acting twin Blake air pump with steam and air cylinders 10 and 20 in. in diameter respectively, 15 in. stroke, is installed. An Ohmen centrifugal circulating pump with a capacity of 3,000 gal. per minute furnishes the cooling water. A bilge pump 7½ x 5 x 6 in., sanitary pump 4½ x 2¾ x 4 in., and fresh water pump 4½ x 2¾ x 4 in., all of Blake pattern, are installed. The feed tank is fitted with a tray filter. A feed water heater using exhaust steam from the auxiliaries and a cartridge grease extractor on the feed line, both of Reilly type, are also fitted. An electric generating set is provided and the boat is wired for sixty 16-candle power lamps and one 14-in. searchlight.

The rudder is of cast steel and the steering gear consists of a Williamson steering engine with a hand gear for use in emergencies.

As usual the crew live in the fire station ashore and therefore no accommodations are provided on board.

Under the direction of the architects, McAllaster & Bennett, the hull was built by the Puget Sound Shipbuilding Co., Seattle, the propelling engines by the Fulton Machine Works, Seattle, the boilers by the Mosher Water Tube Boiler Co., New York, the fire pumps by the American-La France Engine Co., Elmira, N. Y., the copper pipes by the Seattle Copper Works and the electrical equipment by Buxbaum & Cooley, Seattle.

Taking due account of the cost of labor and materials on the Pacific coast, the architects estimated the cost of the Duwamish, before the bids were opened, to be $123,112, to which must be added the architects' fees amount-



SECTION AT PUMPS LOOKING FORWARD.

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ing to $6,000, making the total estimated cost of the boat $129,112. The actual contracts let totalled $117,586,62, but including the extra amount required to harmonize the various separate contracts involved and the compensation of the architects, the total cost of the boat to the city reached $128,400.

The Largest Commercial Gas Power Boats in the United States

IN THE world of marine engineering nothing looms larger today than the possibilities of the internal combustion motor applied to boats engaged in commercial service. From an inauspicious beginning less than 20 years ago, the marine gas engine has risen rapidly from the purely experimental stage to a point where it is not only a recognized, standard motor for pleasure craft of all descriptions, but is also a strong competitor of the steam engine in many lines of commercial service.

It is only in very recent years, however, that the internal combustion motor has been tested to any serious extent in boats of over 50 gross tons register in classes of service where the steam engine would be met in direct competition. In 1906, the Standard Oil Co. launched on San Francisco bay the steel twin-screw gas propelled oil barge Benicia. The Benicia is 140 ft. in length and has a draught displacement of 500 tons. In 1907, the same company launched another oil barge similar to, but larger than the Benicia. This boat, which is said to be the largest gas-driven vessel in the United States, was named Contra Costa, and has a load draught displacement of 1,580 tons. Very little has been published concerning these two boats, but they have been quietly and steadily at work nearly every day during the past two years. They have now been in commission such a length of time that their performance is of value in demonstrating the practicability of gas-powered boats of large size, engaged in continuous commercial service. A study of the hull and engine details of these boats and of their service record is well worth while.

Deck plans and an inboard profile of the Contra Costa are shown in Fig. 1. The hull, which is constructed of steel, was built by the Union Iron Works Co., San Francisco, and the entire engine equipment was furnished by the Union Gas Engine Co., East Oakland, Cal.

The boat is 189 ft. in length between perpendiculars, 37 ft. molded beam and 13 ft. 6 in. molded depth. The vessel was designed for bay service and to have a maximum carrying capacity on the given dimensions. For this reason the model is made very full, with a bluff bow, parallel sides and rounded stern; the bottom is flat and the midship cross sections are practically rectangular.

The liquid cargo is carried in six oil tanks formed by four transverse and one longitudinal bulkhead. Each tank is about 25 ft. in length and holds from 1,150 to 1,200 barrels (42 gallons per barrel), the total capacity being 300,000 gallons of oil, weighing 1,058 gross tons. To protect the tanks from external injury and the ship from foundering in case of accident, collision bulkheads are fitted at the forward and aft ends of the tank compartments.

Accommodations for the crew are provided in the steel deck-house located forward, there being one room for the chief engineer, one room for the assistant engineer and oil, one room for the cook, one large room for the four deck hands, one toilet, one mess room and galley. The pilot house is situated above the deck house. It is equipped with the usual navigating equipment, including a standard engine room telegraph. In the texas behind the pilot house are situated rooms for the captain and the mate.

Fig. 1 also shows in plan and elevation the arrangement of the pumping and propelling machinery. The engines are located in a compartment aft of the cargo tanks. On account of the absence of boilers the saving in space occupied by machinery is about 50 per cent; and the saving in weight adds materially to the cargo capacity of the boat without increasing her dimensions or the power required. All power used on board for all purposes is generated by internal combustion engines.

Main Engines.

The propelling equipment consists of two engines of 250 brake horsepower each, having six single-acting, four-cycle cylinders, 12½ in. diameter, 14 in. stroke. Each engine is coupled through a self-contained clutch and reverse gear to a three-bladed bronze propeller, 6 ft. diameter, 3 ft. 8 in. pitch. It will be noted that the pitch ratio is only 0.61, which is unusually low for reciprocating engines, but which is, of course, due to the relatively high rotative speed. The tail shafts are of steel, 6 in. diameter, cased with brass, and run in the usual lignum vitae bearings. With engines making from 240 to 260 R. P. M., the speed of the boat is about eight knots, loaded.

The fuel used is No. 1 engine distillate and is stowed in two steel tanks built into the after corners of the engine room. The fuel is handled by two small pumps attached to the main engines and is sent through retorts in which it is volatilized by the heat of the exhaust. The effect of the retort action is very marked when the boat is started; the exhaust is quite smoky until the retort becomes heated, about 10 or 15 minutes, when the exhaust becomes clear and smokeless.

Gasoline-Driven Pumping Equipment.

The cargo is handled by a specially designed pumping system. One 85-H. P., three-cylinder vertical gas engine drives two 8-in. Krogh rotary pumps by means of a Renold silent chain. Each pump can deliver about 21,000 gallons of oil per hour under ordinary conditions of temperature and lift. With cold oil, long pipe lines and high lift, this capacity is somewhat reduced. There are two suction mains, each 8 in. in diameter, extending the full length of the tank compartment. Branches, 6 in. diameter, lead from these mains to each tank. All valves are of straight way gate type, which are not easily obstructed by dirt, chips or other debris. The valve stems are carried to the upper deck through oil tight stuffing boxes, so that all pumping may be controlled from the deck. By-pass connections are provided so that the suction pipes can be used for loading as well as discharging cargo. The regular discharge mains are 6 in. in diameter and have one coupling on each side of the vessel forward and one on each side aft for hose connection with the wharves.

One 25-B. H. P., two-cylinder vertical engine is directly connected to a 10-k. w. generator, which furnishes electricity for lighting and also power to operate an electric windlass forward, an electric capstan aft and electric bilge and fire pumps in the engine room.

Small Crew Necessary.

In bay service, Contra Costa carries one captain, four deck hands, two engineers, one oiler and one cook. The boat, however, has a United States certificate for coasting service and in that case would carry an additional deck

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officer and engineer. To put it another way, nine men are carried in bay service and eleven at sea. The crew of the average steam schooner of equivalent capacity consists of from 15 to 18 men in ocean esrvice.

Contra Costa and her companion, Benicia, were both designed by John Haug, naval architect for the Standard Oil Co. and were built under his supervision.

Barge Benicia.

The steel, twin-screw, gas-powered barge Benicia was built at the Standard Oil refinery at Point Richmond, Cal., in 1905-06. Her machinery was also built by the Union Gas Engine Co., of East Oakland, Cal. In general, Benicia is similar in construction and equipment to Contra Costa. She is 140 ft. in length between perpendiculars, 33 ft. molded beam and 7 ft. 6 in. molded depth. Her load draught is 500 gross tons. She has a cargo capacity of 88,000 gallons of oil, weighing 310 gross tons.

Accommodations for a crew consisting of a captain, two engineers, one oiler, two deck hands and one cook, seven men all told, are provided in a deck house forward and in the forecastle forward under the main deck.

The six cargo tanks are formed by four transverse and one longitudinal steel bulkhead, collision bulkheads being fitted forward and aft.

Each of the two main engines, with three single-acting cylinders 13 in. diameter, 14 in. stroke, develop 125 B. H. P. at 300 R. P. M. The engines are coupled to three-blade bronze propellers, 4 ft. 6 in. diameter, 3 ft. 6 in. pitch, the pitch ratio being 0.78.

One 30-H. P., two-cylinder Union engine driving a Gould rotary pump having a capacity of 21,000 gallons per hour under normal conditions is used to discharge cargo. The same engine also drives a generator, furnishing electricity for light and power.

The performance of these boats has been quite remarkable. They have been steadily at work for over two years. Very little trouble has been experienced and the machinery has proven itself reliable and dependable at all times. The fuel consumption of the engines is from one-ninth to one-tenth gallon of No. 1 engine distillate per brake horsepower hour. With distillate at 9 cents per gallon (Seattle prices) the fuel cost of operating Contra Costa for 10 hours, assuming the maximum consumption given above, is $49.25.

Comparison with Steamers.

In comparing the gas-power barges with equivalent steamers, the Standard Oil Co. makes the following statements:

1. The weight and space of

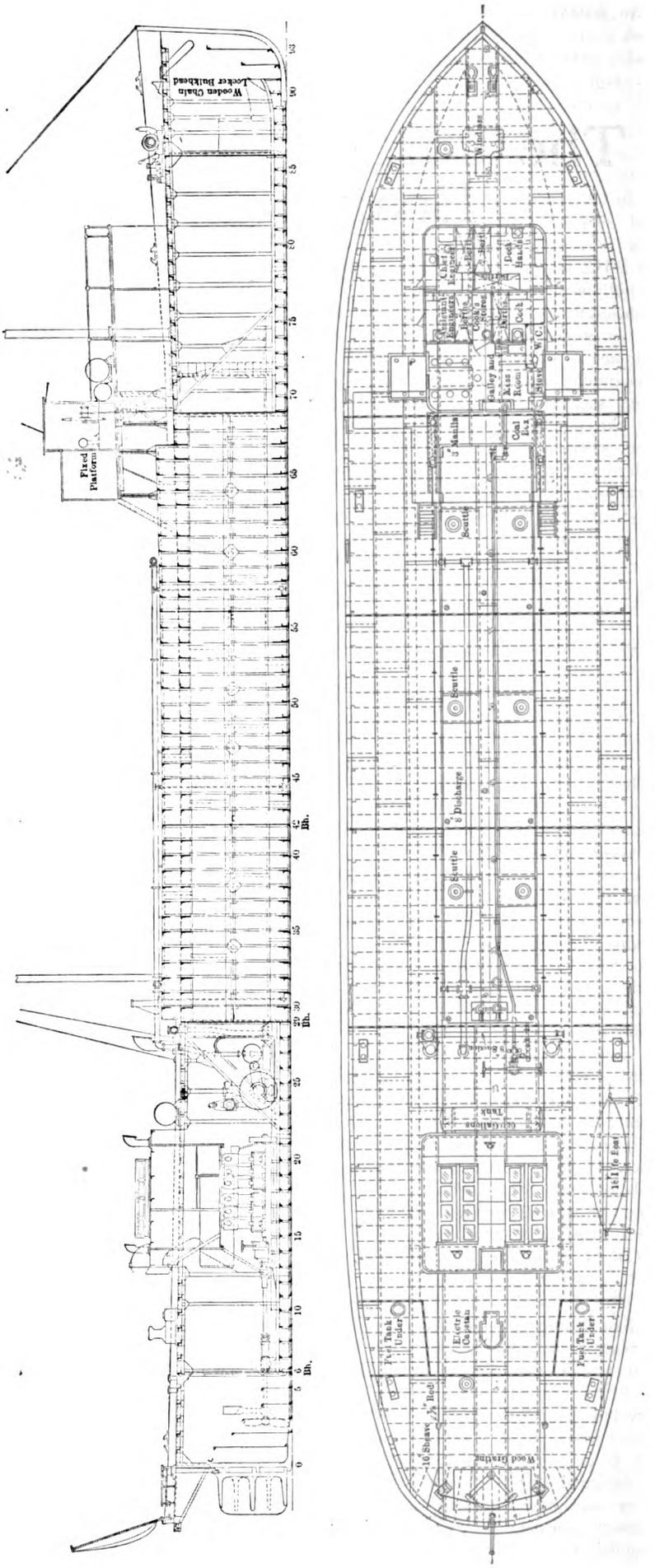

FIG. 1—LONGITUDINAL SECTION AND DECK PLAN OF GAS-POWER BARGE CONTRA COSTA.

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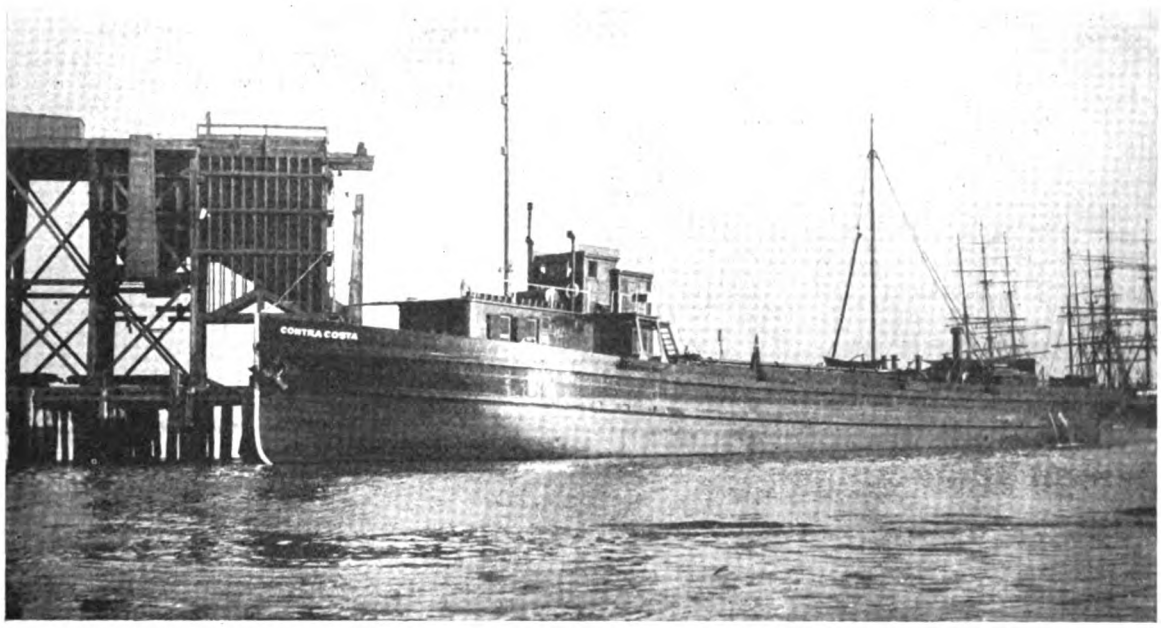


THE GAS-POWER BARGE CONTRA COSTA.

machinery and fuel being much smaller, more cargo can be carried on the same dimensions, or the same cargo on smaller dimensions, or on less draught of water, as may be preferred.

2. First cost is about 20 per cent less in cost of machinery, and should fall still lower with the development of large marine gas engines.

3. The crew may be smaller, as no firemen are required.

4. From our experience, with one boat in service about four years and another about two years, the cost of fuel is less, as no fuel is used when engines are not running, and the engines are more economical as to the quantity used than steam engines using oil for fuel in steam boilers.

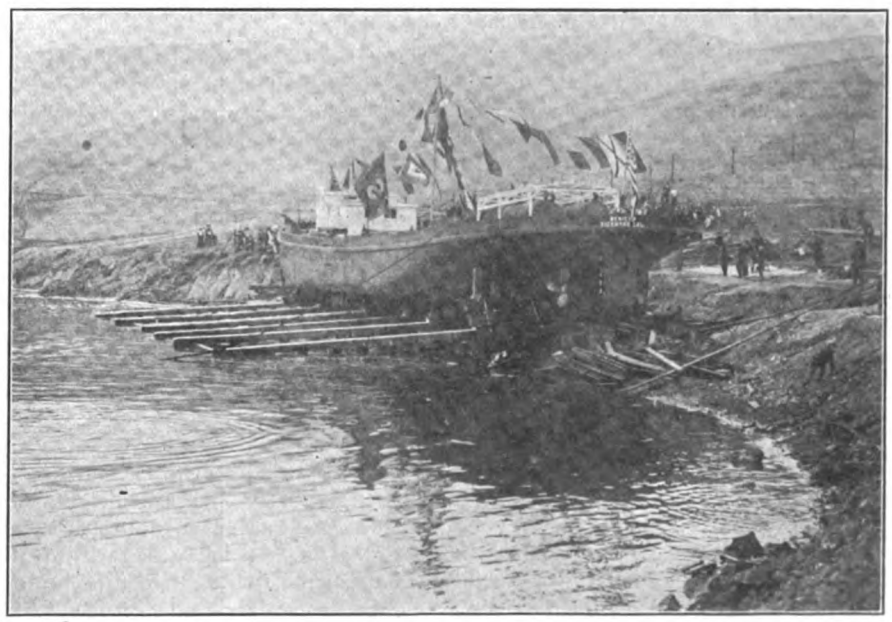
5. The repairs required are quite insignificant, compared to those of a steam plant, and most of them are of such a trivial nature that they can be done by the engineers in charge.

6. On our steam vessels we require three days every two months for scaling boilers, which is not necessary on gas-power boats. Our gas boats usually pass their annual inspection in one hour.

Two considerations have prevented these boats from being used, as yet, in seagoing service. It is difficult at the present time to find engineers of sufficient responsibility, familiar with large gas engines, to be trusted with the engine room management on sea voyages. It is easy to find men to operate gasoline engines and it is possible to find a few on the Pacific coast who are trustworthy and responsible, but at present the supply of capable, seagoing engineers, familiar with gas power, is limited and this fact, it is authoritatively stated, is responsible for a large share of the hesitation on the part of the owners to place their big gas-driven vessels in the coasting trade. The opinion is also held by the best authorities that the reverse gears with which the larger gas-power boats are fitted are not a proper and fit device for seagoing ships. No matter how well these gears are made, or how carefully designed, they lack the absolute reliability of a solid coupling between the engine and propeller, and their action, being dependent upon friction, is not positive.

To overcome the aversion which marine engineers have for reverse gears transmitting large powers and still secure the higher economy of gas engines, with the flexibility of steam engines, the gas-electric combination has been suggested. The main engines in this case are directly connected to electric generators and run always in the same direction at constant speed. The propellers are driven by electric motors, which may be stopped, started, reversed, accelerated or retarded in speed by well known controlling devices.

Whatever system may be adopted, it is safe to conclude from the capable service rendered by the two boats described herein and from their phenomenal freedom from repairs or breakdowns, that the large gas-driven vessel will, within a comparatively short time, be extensively employed in sea-going service.



LAUNCHING THE GAS-POWER OIL BARGE BENICIA.

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THE LIGHT HOUSE SERVICE.

The United States Light House Establishment, as an organization separated from the Revenue or direct control by the secretary of the treasury, dates back to 1820, when Stephen Pleasanton, fifth auditor of the treasury, took charge, under the popular title of general superintendent of lights. Mr. Pleasanton was in charge until 1852. His administration was praiseworthy, but many complaints were lodged and many investigations called for. The general conclusion of the investigators was to the effect that Mr. Pleasanton had done the work to the best ability of one man, but that the service had grown beyond the limit of one man's capacity.

In 1846, after an examination tour abroad, studying other services, Lieuts. Thornton A. Jenkins and Richard Bache of the navy made a report to the Hon. R. J. Walker, secretary of the treasury. In commenting on this report, Secretary Walker said:

> It is obvious that a very considerable range of practical and theoretical knowledge is required for the improvement of the system; more than can be looked for from one individual, however eminent in science. The proper organization of the system, and planning of its details, require the efficient head of a bureau familiar with the working of a general organization—a person capable of furnishing information in regard to the coasts and harbors from actual surveys; persons minutely acquainted with the wants of navigation, with details of location and construction of the Lighthouses, and with the chemical and mechanical principles involved in lighting. While this knowledge cannot be obtained from one person, a board may be organized, without expense to the government, by which the system may be considered in all its particulars, and an efficient plan of action recommended.

In 1851, Congress authorized the appointment of a board to consider and report upon the matter of organizing the Light House Service. This board was made up of navy officers, army engineers and the superintendent of the coast survey. The French service was, at that time, in advance of all others and was supposed to have been followed largely in planning ours.

In the French service, the executive head—known as the "Director of the Service"—is an inspector general des Ponts et Chaussees. The French corps des Ponts et Chaussees is the corps of engineers having charge of works of river and harbor improvement, and inspector general means a rank in that corps. Inspector des Ponts et Chaussees in France means Colonel of Engineers United States Army, in our country. An Engineer-in-Chief des Ponts et Chaussees (Lieut.-Colonel or Major of Engineers in this country) is secretary to the Light-House board—known as the Commission des Phares. The Board of Commission is a council of deliberation to which important matters are referred for an opinion—a purely advisory body composed of engineers, as experts on building and navigation; of navy officers, as experts on navigating; of a hydrographic engineer, as an expert on hydrography; and of a Member of the Institute, as a general scientist. To them are referred such matters as the location of lights to serve the best interests of navigation; any general change in the policy of lighting; the proper height of lights and their character; and, in fact, matters of general policy in lighting and lights. In matters of engineering construction, the director sends the plans to the general council des Ponts et Chaussees (similar to our board of engineers) for final review. The actual construction, operation and care of the aids to navigation, are in the hands of engineers des Ponts et Chaussees, who are located at various points along the coast and who are also in charge of works of river and harbor improvement. The inspectors of the service are officers des Ponts et Chaussees senior to the district engineers.

In our attempt or failure to copy this admirable institution, we made the light-house board (an organization of eight members) the executive head of the service; made two secretaries to the board—a naval secretary and an engineer secretary—thus dividing responsibility; and put an inspector and an engineer in each district, thus having another divided responsibility.

This organization has done admirable work in spite of the absolute lack of modern business principles in its make-up. Two great bars to speedy and efficient work exist—too large a head (an organization of eight members) and divided responsibility and jurisdiction over common ground. Both of these evils were mentioned by the President in his annual message to congress, and by Secretary Nagel in his annual report.

The French service is a success; is based on business principles of organization; has been copied by many other nations; and is admitted to be the best. Nagel and by the light-house board, to be, in some respects, a failure. Then Ours had done admirable work, but is admitted by the president, by Secretary why should we not give the real French plan a fair trial? The Mann bill aims at a decided change in the organization, but does it not take us back to the organization of 1840? It deprives the service of the advantage of the discipline of a military service, which the president states in his message to be of great benefit to the organization.

The French organization, applied in this country, would be as follows: The Chief of Engineers United States Army would take the place of the director in France; an assistant in his office would take the place of the second executive of the French service and, like him, would be secretary of the light-house board; the light-house board would be composed as it is now (except the two secretaries) and would be advisory in matters of general policy, of location, of lights and of lighting; the construction, care and operation of lights would be in the hands of the river and harbor engineers; the general inspection of the work would be in the hands of the division engineers and the two executive officers of the service; and our general council des Ponts et Chaussees would be the board of engineers.

The conditions suggested by Secretary Walker over 60 years ago—

> the efficient head of a bureau familiar with the working of a general organization — a person capable of furnishing information in regard to the coasts and harbors from actual surveys:—

can readily be found in the office of the chief of engineers.

We would thus do away with light-house districts and their double organizations of offices, clerks and light-house tenders; we would not take the chances of going back to our organization of 1840, which failed: We would correct our failure in organization of 1852—supposed to be on the French mode; and we would have the actual French organization, which has proved itself to be a success, not only in France, but in many other countries, where the French plan has been followed. If the French engineers who perform the duties of river and harbor improvement, have satisfactorily performed the kindred duties of caring for the aids to navigation, why should not our river and harbor engineers perform the same duties at a great saving of cost and organization?

SOME INTERESTING SHIP-REPAIR JOBS AT ANTWERP.

Herewith are reproduced photographs of two interesting ship repair jobs, which are being dealt with by the Antwerp Engineering Co., the well known ship repairers, engineers and dry dock proprietors of that port. The enterprise of this company has long been recognized on both sides of the Atlantic, and it possesses an enviable reputation for the smartness of its work and the up-to-date nature of its plant and facilities. The company is one of the largest of its kind in Europe, and deals with every class of contract concerning a ship whether hull, machinery or boil-

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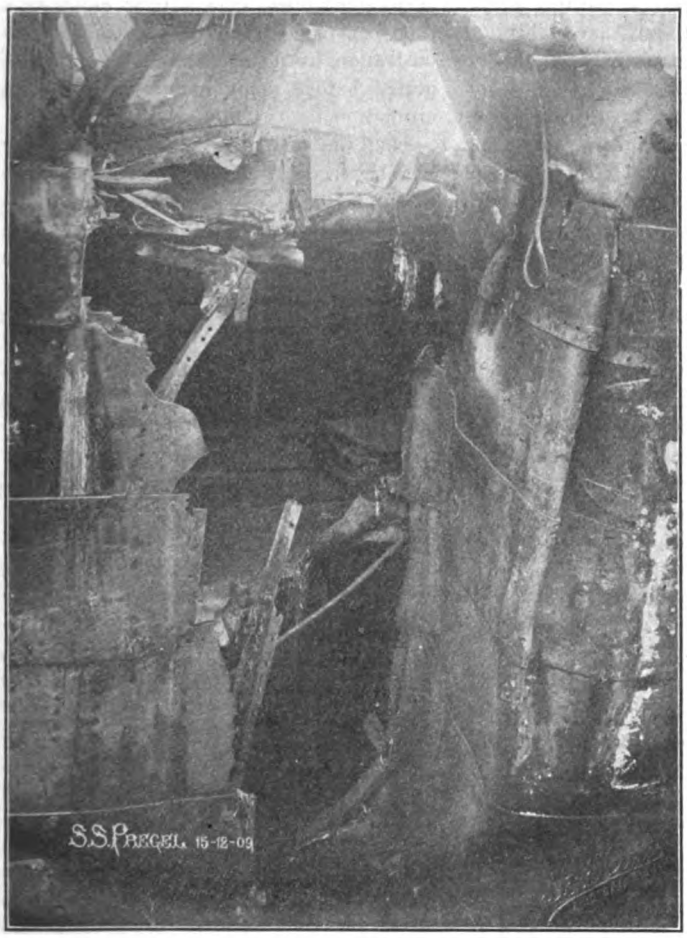

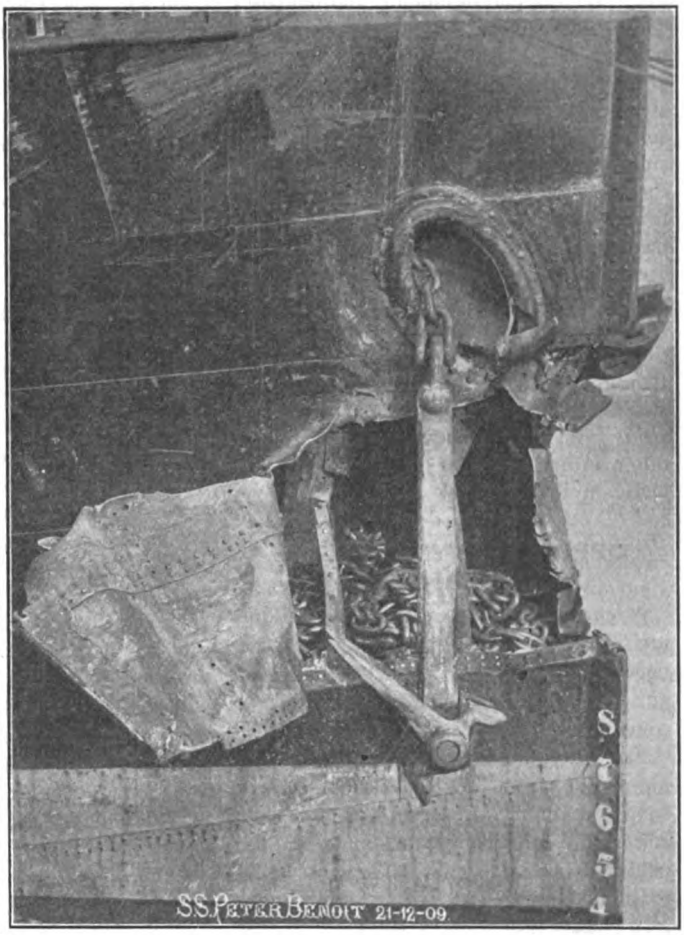

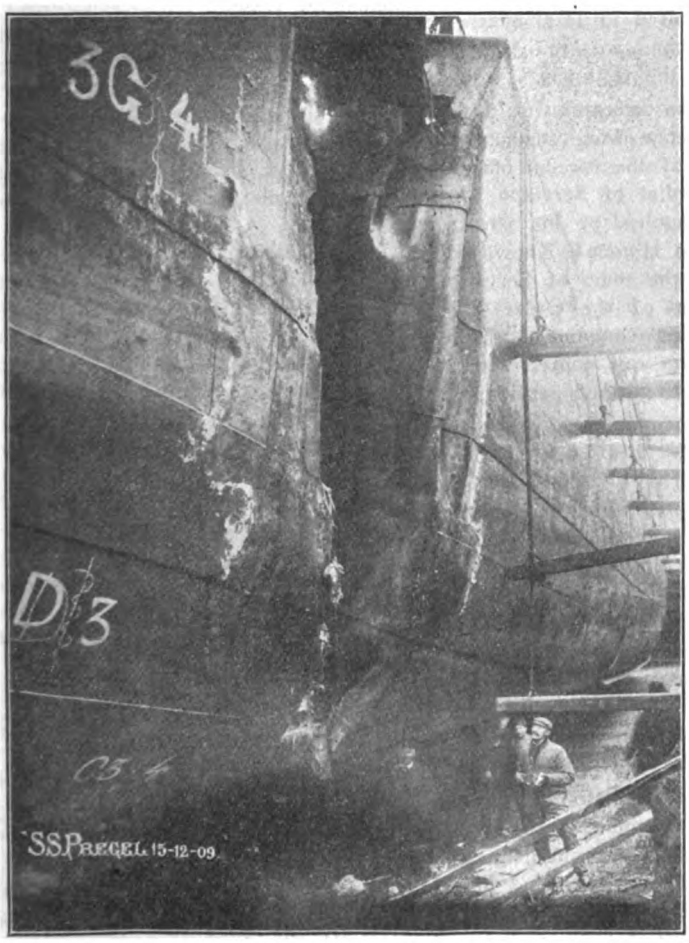

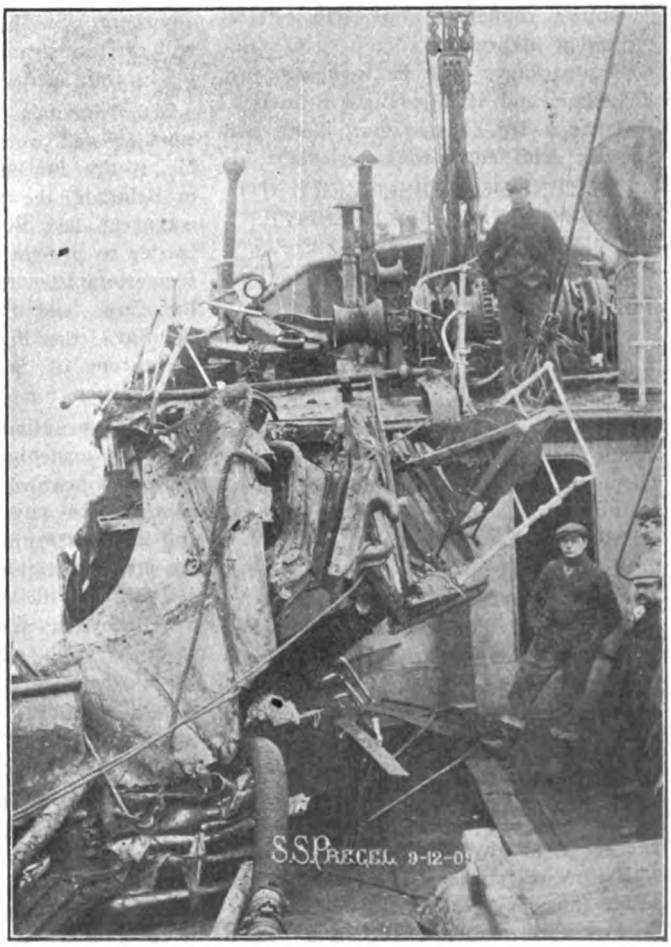

TWO INTERESTING SHIP REPAIR JOBS AT ANTWERP.

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ers. One photographic reproduction shows the steamer Pregel in the company's dry dock, undergoing repairs after having being in collision with the steamer Werdenfels. The wide fracture sustained by the Pregel on her port side abaft the forecastle is plainly seen; the break of the top-gallant forecastle being carried away, also the main deck having been cut into, while it will be seen that the forecastle has been generally wrecked. Another interesting repair job quite recently undertaken by this company relates to the S. S. Peter Benoit, which was in collision with the steam dredger Gelderland. It will be seen from our illustration that among other injuries, the vessel is holed very badly in the forepeak.

OPPORTUNITY KNOCKED AGAIN.

A correspondent sends us the following glowing description of the newest opportunity offered the trusting and guileless capitalist, which has recently come into his hands.

Far be it from us to disparage the pipes, the paste and the liquid. We have no doubt whatever as to their efficacy in enlisting capital, and that the public demonstration will be successful to admiration. The saying that "there is a sucker born every minute" is just as true today as ever, and among the "country's capitalists" the birth rate is somewhat higher.

The packages will be switched just the same, and if Mr. Bora Bekovitchsky has a lap or two start there will another debit entry to experience.

TREMENDOUS DISCOVERY TO REVOLUTIONIZE PRESENT MODE OF EXISTENCE. KING PETER'S MAN INVENTS WONDERFUL FUEL OF FUTURE.

Coalless fire, which will send a 20,000-ton ship across the Atlantic at a cost of about $12 a trip—that's the newest successor of wireless telegraphy, wireless telephony, fireless cookers and other inventions which contradict the well established terms of science.

Wonders are claimed for this invention. The inventor, Monsieur Bora V. Bekovitch, of the Servian capital, gave the following description of his invention:

"My invention consists of a fire which excludes coal, wood, gas, benzine and every other fire-producing means known to our present-day science. It makes no smoke, no soot, no ashes, and is cheaper than any fuel that is available today. Much stronger heat is generated by it than by any present combustible. It does away with the need of unsightly chimneys, and the very nature of its substance precludes any possibility of danger; it cannot explode and has no odor.

"Its use in homes, in the factories, on locomotives and steamers will bring about conditions of ideal cleanliness and the motive force provided by its use will be greater far than that of any combustible available at the present time. Of small volume, this fuel needs but small room for its storage and does away, for instance, with the engine fireman, only one man being necessary to handle and start it. It can be adapted to present engine rooms and locomotive fire boxes. But eventually construction of steam engines will be remodeled, because steamships nor locomotives will not need smokestacks nor spark arresters.

"What is it? It consists of a special arrangement of pipes and tubes, which can be inserted in any fire-box. On the pipes is a coating of paste. These pipes are set in a kettle and surrounded with a liquid. Yes, there is a liquid—that and the paste and the process is my secret. An air pump introduces air into the liquid and then the fire is obtained.

"This liquid is no new element. I have not discovered a new element, but a new composition. It is to be had in the smallest village—can be produced anywhere. Six hundred to 1,000 quarts will carry a steamship across the Atlantic, a train across the continent."

M. Bekovitch, the inventor of this startling and wonder-working combustible, is the attache of the foreign office in Belgrade, the capital of Servia. He was sent last September by his royal master to present to Horace G. Knowles, former minister to the court of Servia, the Cross and Star of the Order of St. Sava, the highest compliment that the throne of Servia can confer upon a foreigner for distinguished service.

The presentation of this royal decoration was made by M. Bekovitch in the Bellevue-Stratford Hotel, in Philadelphia, in the latter part of September, and was interestingly commented on by the press throughout the country. After carrying out the commands of his king, M. Bekovitch asked leave of absence from service and proceeded to New York, where he is at present conferring with the country's capitalists who are preparing to launch his invention by means of a public demonstration.

The nature of this invention and the means by which it accomplishes its revolutionary performances are guarded as a strict secret by M. Bekovitch and the little coterie of those whom he has interested in the project, but the fact has been ascertained that a trial motor has been constructed and that an early demonstration of its usefulness is to be expected before many months have rolled around.

That the news of the great discovery will be received with the greatest skepticism is to be expected by those interested, and no true estimate of its value to mankind can be offered until after the public demonstration.

However, won't it seem strange to be suddenly transported in an enlightened age when furnaces and coal and ashes and other relics of a barbarous age are but distant memories?

TORPEDO BOAT SANTA CATHARINA.

The official full speed trial of the torpedo boat destroyer Santa Catharina, built for the Brazilian government by Messrs. Yarrow & Co., Ltd., of Glasgow, took place on Wednesday, Feb. 2, on the Skelmorlie deep water measured mile at the mouth of the Clyde, and the contract speed of 27 knots, during a continuous run of three hours, carrying a load of 100 tons, was easily exceeded.

The trial was under the supervision of Capt. Bartholomeo Francisco de Souza e Silva and Capt. Godofredo da Silva, representing the Brazilian Naval Commission, and Capt. Lessa, who will command the vessel.

The Santa Catharina is the eighth of the ten destroyers ordered by the Brazilian government from Messrs. Yarrow. The first six vessels are now in commission in Brazil. The seventh will be leaving Glasgow shortly, and the ninth and tenth vessels are ready for launching.

In these destroyers strength of construction and good seagoing qualities were deemed—as in the British Navy—of even greater importance than high speed, as both the British and Brazilian destroyers have a guaranteed speed of 27 knots.

The dimensions of the Brazilian destroyers are: Length, 240 ft.; beam, 23 ft. 6 in. They are propelled by two sets of four-cylinder reciprocating engines of 8,000 H. P. collectively, balanced on the Yarrow, Schlick & Tweedy system. Steam is supplied by two double-ended Yarrow boilers of the latest type.

Capt. H. H. Parsons of Detroit, who has been in the employ of the Cleveland Cliffs Iron Co. for a number of years, has resigned to go into business in Cleveland. He will be associated with H. K. Oakes, of Detroit, in the vessel and brokerage business. Capt. Parsons sailed the steamer William G. Mather last year.

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Naval Architects and Marine Engineers

(Continued from February issue.)

MR. Nixon: Is there anything in our by-laws that would prevent that? I do not think so, but I am prompted to ask the question because I had an idea in the beginning that we would not attempt to influence legislation at all at our meetings on this subject. If this association is interested in this subject sufficiently, I think it would be a good thing to have the motion carried.

Chairman Taylor: The chair will not look for anything in the by-laws at the present time on that question. The chair wishes to say that he looks upon this question of the merchant marine as one of vital interest, not only to ourselves as naval architects and marine engineers, as I said yesterday, but as patriotic citizens, and because we are members of the Society of Naval Architects and Marine Engineers, is no reason why we should not have an active interest in anything that will produce what I believe, and what I believe you all believe, will be a great benefit to the country at large. (Applause.)

I met at the chamber of commerce dinner last evening a well known banker, who is largely interested in ship building, that is to say, in a large shipbuilding yard. He put up to me this novel proposition—if it was bad taste for shipbuilders to advocate an increase of the navy, simply because we were ship builders? Now, I dissent entirely from any such position as that, and, for the reasons that I have already given you, I am not inclined as chairman to look for anything in the by-laws to prevent this motion from being put before you, and I trust that no one else will try to do it. The question is before you, on Mr. McFarland's motion, seconded by Mr. Stratton, and we will be glad to hear from any gentleman who desires to speak on that question.

Clinton H. Crane: I should only like to say that if there is something in the by-laws which forbids us to put such a motion, we should abrogate that before putting the motion. Let us be regular in the matter.

Discussion by Mr. Stevens.

E. A. Stevens: May I explain, Mr. Chairman, that this paper was the subject of discussion in the council as to the propriety of presenting it to the meeting. That question was pretty thoroughly threshed out. I believe the sentiment of certainly a large majority of the members was that under a fair interpretation of the rules, this subject and paper could not be properly presented to the meeting. The subject is one of vast interest, not only to the naval architects and marine engineers, but to ship owners all over the country, and we felt that no narrow interpretation of the rule could possibly apply there. The wording of the rule is that the discussions shall be confined to subjects relating to the art and science of shipbuilding. If the very existence of the art of shipbuilding is not related to the subject of shipbuilding, I do not know what the word means.

Spencer Miller: It seems to me it would be of tremendous value if this society could put into concrete form its suggestions to Congress as to the way of encouraging a merchant marine. If the committee can meet and arrive at a concrete suggestion, that is not too long, it would be of immense value, and it seems to me it would be proper for the committee to be appointed to ascertain the opinion of the members of this society. It is a question, a very grave question, in my opinion, as to whether we want to appoint a committee to go to Congress and lobby, because I am not quite certain that the society might be ready to stand behind the committee in all that it might do, but if we can get our opinions concentrated into a printed form, it seems to me it would be of tremendous value.

Perhaps the council, therefore, if it is left to them would say how far that committee should go—I am a little hazy as to the powers of the committee. I think that we can well afford to leave the matter to the council for the appointment of the committee, and especially the elaboration of their work.

Chairman Taylor: Since Mr. McFarland made his remarks on this paper, there have a number of gentlemen come into the room. The gentleman who has just spoken has really expressed what Mr. McFarland suggested before this meeting, and I will ask Mr. McFarland to again state his remarks as briefly as he can, and to the point, as to what he wishes this committee to do, for the information of those who were not here before.

A Most Appropriate Body.

Mr. McFarland: I find there is one point in the written statement, which I have prepared, to which I did not refer when I addressed the meeting verbally before, and it is worthy of reading, simply as showing why it is eminently proper that our society should take up this matter. I feel, too, that our society is probably the most appropriate unofficial body before which this subject of a ship subsidy can be discussed. The bulk of our members being interested in ship building have a vital interest in the subject and those members who are ship owners are interested from that side. Certainly no other body has the information and the great personal interest which are calculated to bring about a discussion of the highest value.

Our society has already committed itself favorably to the general policy of ship subsidies, so that I take it the object of the discussion today should be rather as to details than as to the general policy, on which our views can hardly have changed in the last few years. When it comes to discussing details there will, of course, be a great variety of opinions as Mr. Dickie seems to have anticipated in the closing paragraph of his paper. It really seems to me that best results would be obtained, if we do not rest satisfied with a discussion to be spread upon the minutes, but rather if we appoint a strong committee representing both the ship owners and the ship builders, with instructions to consider the subject carefully, formulate the reasons which would be likely to appeal to Congress for a subsidy, and then be authorized to appear before the committees of Congress as representing our society.

Secretary Root's South American Trip.

What I mean by that, is this—you will all recall at the time in 1906 when Secretary Root made his famous address at the Trans-Mississippi Congress, a committee of our society was appointed, of which dear old Uncle Charley Haswell was the chairman, to prepare a suitable resolution of thanks to Secretary Root expressing the fact that this society heartily endorsed his stand. That is what I mean by saying that the society has already gone on record as

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being favorable to this idea of governmental assistance when it comes to details.

I remember at one of the banquets we held, I think in 1906, when Senator Gallinger was present, and Harvey Goulder was there and made a speech, I noticed there was a tone like this—Oh, well, what does it amount to, the amount is only $15,000,000 a year, and that is only 20 cents for each man, woman and child in the United States. Any one can ask for anything if it is only a little matter.

You have heard the discussion here today, and you know that there is one man who is obviously a proper man to go on the committee—you all know him, he is a master of the subject, and he has made a thorough study of it. I do not believe the council will hesitate to appoint him. The council can select the others, and with brainy men, who have a vital interest in the matter, and will see the thing is done, I think something will be done. Meetings of chambers of commerce or a dinner, usually end in "hurrah boys, we all vote for it," but you do not get anything done.

E. A. Stevens: I want to say a word in reference to the motion, especially in reference to what has been said as to subsidies. There are a large number of benighted people in this country who have objections to taxing one man for the benefit of another man's business, and if the subject is put in that way, as it has been put in the past, judging from the experience of the past, I feel justified in prophesying that no great good will come from the undertaking. It seems to me the help this body can lend to such a matter is by giving whatever demand may go direct to the national treasury its true meaning and intent. There are many whose views can be developed in discussion on this floor, and may evidence in that manner the views of not only the owners of the ships and the yards that build them, but of the men trained to the sea who navigate them. It seems to me that that aspect is the aspect which you want to put before Congress, to secure financial help. I understand that that is the basis which is given in Japan for the help that Japan has extended to its ships, that in order to have a reserve of men, exclusive of the reserve of merchant ships, but a reserve of men only for the service, it will be necessary for the empire of Japan to maintain a training establishment which would cost much more than she now expects to spend. It seems to me those gentlemen serving in the line of the navy would certainly be able to throw some light on the need of the service for such a trained body of men behind it, and I trust that we will hear something on that point of the question in this discussion.

Duty of Secretary of Commerce.

E. P. Stratton: I do not want to do all the talking on the subject, but a reference has been made that this association did not want to help in this matter. Several years ago in this society I made some remarks bearing upon this subject, and I then took exception to the fact that we had not a secertary of commerce who could speak for the commerce of this country. Today we have one, and it is clear to me that it is properly the duty of this committee to address their efforts to the secretary of commerce, who should address the House and Senate of the United States on this subject, and be the instrument of this society obtaining the necessary legislation.

F. L. Du Bosque: It seems to me that Mr. McFarland has struck the keynote, which has not been touched on before in the discussion of subsidies. No matter what our individual opinion may be about the principle of protection, the great majority of the votes of this country have decided that we shall be a protection country. We must bear that in mind in treating this subject. The result of that protection is that every industry in this country pays its employes a higher rate of wages than is paid to the employes of similar industries in any other country. We may not be opposed to that principle, because it has produced in this country a very healthful condition which is the envy of every other country. The ship owners and the ship builders know the reason why we cannot compete with foreign commerce, because we cannot afford to pay the employes engaged in the operation and navigation of our vessels the prices that our protected industry demands that they shall be paid. While I have read almost everything I could lay my hands on, as to the reasons for a subsidy, I have yet to find any case where this particular feature has been touched on in such detail as to bring it prominently before the people. The sole reason, to my mind, why we cannot operate ships, is because the rate of wages we have to pay to the men to navigate them is so much greater than is paid to the men of other countries.

Should Protect the Industry.

Now, if we are confined to protection, we must protect that industry as well as every other one in the country, and the only way we can protect it is by a subsidy, if you will, by the payment of high prices for carrying the mails, or some compensation to the ship owner to compensate him for the difference in the rates of pay that he has to pay his men.

Mr. McFarland: It has been suggested to me that the motion as put originally was not in what might be called a formal shape, and one of our good friends has kindly worded it for me in proper shape, and with your permission, Mr. Chairman, and that of the society, I will submit the following as the resolution before the meeting, instead of that contained in my verbal remarks:

Upbuilding Our Merchant Marine.

Whereas, The rehabilitation of the American merchant marine is essential to our commercial prosperity and independence; therefore,

BE IT RESOLVED, That a committee of seven be appointed to consider this question and suggest means by which such rehabilitation may be brought about.

Jacob R. Andrews: I do not want to take up the time of the society. I simply want to ask one thing which I have not heard touched on, and that is all of you who have been interested in forwarding this porposition, or attempting to get legislation, have known that the thing which has been more against the successful outcome of our efforts has been the squabbles and troubles among the people who were attempting to get legislation, and I believe that Mr. Dickie's paper and the discussion which has been brought out will be conducive of a great deal of good, and I think that Mr. McFarland's motion is absolutely in order, and that there is no body of men in the United States who are better qualified to urge legislation of this character upon Congress than the members of this society. For instance, while I agree with Mr. Dickie in a great many of his ideas, and while I am not sufficiently familiar with the subject to know what is the best, whether it is subvention or whether, as Mr. Nixon has stated, a discrimination, that I do not pretend to know, but

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I do know that a certain class of ship owners, some of whom are members of this society, but whom I do not see present here today, for years put off what little legislation we got simply by their antagonism, simply because they could not agree between themselves as to what they wanted. That Mr. Nixon is familiar with.

Chairman Taylor: The question is on the motion offered by Mr. McFarland.

The motion was put to vote and unanimously carried. President Taylor announced that the committee would be appointed after consultation with the council. Adjournment was then taken for luncheon. The committee was later announced by Chairman Taylor as follows: F. T. Bowles, E. A. Stevens, Lewis Nixon, C. B. Orcutt, H. S. Grove, H. D. Goulder and Henry Fenton.

Friday Afternoon's Session.

At the convening of Friday afternoon's session President-elect Taylor announced that George E. Weed had been elected vice president of the society to fill the vacancy caused by Mr. Taylor's elevation to the presidency. Chairman Taylor then surrendered the chair to Rear Admiral Capps.

Richard B. Sheridan's paper on "Material Handling Equipments for Lake Vessels," was then read by the author. This paper touched briefly upon the early development of the ore trade and then described the various types of unloading machines including the Brown, Hulett and Hoover & Mason. It was elaborately illustrated by a series of excellent photographs.

Discussion of Mr. Sheridan's Paper.

Spencer Miller: I think perhaps I may tell a little story I heard in Chicago about two months ago, which will emphasize the importance of the work which Mr. Sheridan has covered in his paper. Mr. Sheridan has told us that at the dock in Duluth a ship is loaded in an hour. It was given to me as a fact that one of these cargo vessels was discharged in Chicago at a lower cost per ton than the same ship was loaded under the chutes in Duluth. I was so impressed with that that I immediately disputed the statement—I said, "How can it be possible that you can take and hoist the cargo out of the ship as quickly as it can run in, when you simply employ gravity," and his answer was that it was impossible to allow the ore to run by gravity unless you had the chute properly adjusted, that it took considerable labor to adjust the chutes, and that to load by gravity was greater than the cost of discharging the ore from the ship.

There is another interesting comparison between the speed of loading under coal chutes by gravity, and discharge by clamshell buckets, which has come to my attention. One of the new United States colliers, the Mars, required 15 hours to take on its cargo of 7,200 tons of coal at Lambert's Point, about 500 tons per hour. Under test of its own winches operating its own clamshell buckets it discharged from one of its ten hatches 117 tons per hour. With all its winches and clamshell buckets operating this would indicate 1,170 tons per hour of total coal discharge, or double the rate at which it was received and stowed. The Vulcan did even better—it discharged from one hatch 180 tons per hour. The Hector still better—190 tons per hour. I think, therefore, I am safe in saying that either of these colliers can empty its entire 7,200 tons in seven and one-half hours.

Archibald M. Main: I would like to ask Mr. Miller or Mr. Sheridan if they have had any other experience, if they came across any type of ore which the grab bucket could not handle?

Mr. Sheridan: The magnetic ore cannot be handled economically with the grab bucket,—the hard lumpy ores, we can do something with them, but it would not be as rapd as hand filling in the hard ores. But where they have been crushed to small size we do very good work with the grab buckets in handling them. The quantity of the hard lumpy ores, however, is so small in comparison to the soft ores, that it is hardly an appreciable item. Naturally, we do not make the same speed per hour in the lumpy stuff as we do with the soft ore.

Vessels Carrying Swedish Ore.

Mr. Main: The reason why I asked this—of course, as shipbuilders, we naturally are interested in the construction of the vessel for carrying different cargoes, and about two months ago it was my experience to see a vessel which had been built on the northeast coast of England by Hawthorne & Leslie, for a German firm, for carrying some ore from some point either in Norway or Sweden, beyond the Arctic circle, and when I saw the boat unloading, I said,—"Why do you not use grabs," and I was informed that the grab would not be suitable for the ore which they carried, and therefore this vessel had to be constructed somewhat differently from the vessels used on the lakes. The type of vessel which I mean is probably familiar to many of the members. I have forgotten the name of the vessel, but she was a rather interesting vessel. This vessel was built with hoppers. Suppose that is one hopper there (indicating on blackboard), this is the hatch on deck, and this was filled with ore. The sketch is a little off here, I am afraid—I could probably for the transactions send a sketch of this boat which I thought was very interesting at the time. They all went into a hopper of this type, and there was a door here, and one here. (Indicating.) Here is the next hopper, and so on. These doors were operated by a lever, and two men were required to operate them, one man pried down the lever while another took a crow bar to help the ore to thaw out. Over each hatch there were a couple of electric cranes which carried a peculiar sort of flat shovel. When the man opened the door, the ore flowed into the shovel to a quantity of about two tons. This was elevated, swung around, and discharged into the car, and was back again for another load, in one minute. That was considered good handling. This form of ship was ahead of the appliances at Philadelphia for conveying our ore, though it may be behind our lake methods, and yet on the whole, I think there is something to be said for that form of ship. They could not take the cars quickly enough away to accommodate the crane. With all the cranes, five of them, working at one time, they would deliver a cargo very rapidly. In addition to that, being a seagoing ship, she could carry ordinary cargo in the spaces between the hoppers when not carrying ore.

I thought it was an interesting vessel, and that it was probably worth while to bring up the question here, to see if it was not possible for our experts in the lake shipping to design a ship to handle this type of ore, and still have it handled by a grab bucket.

Floating Coaling Stations.

Mr. Miller: The discussion of this ship, which we have just heard, reminds me of a scheme of the British admiralty for floating coaling stations. They declared that Welsh coal could not be dug with clam shell buckets, and they wanted to build a floating coaling station, carrying 12,000 tons of coal, and they built it quite similar to the suggestions made, and it has been in use at Portsmouth for a number of years; that is to

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say, there is a large hopper space underneath, where coal is drawn out into bags or buckets and then hoisted in wells. The difficulty they met with, and which they had to overcome, was that the Welsh coal was a large lump, and would arch, and would not come out of the holes, and they had considerable difficulty in making it flow, because as soon as three or four lumps would fall, as they would after a while, around the opening, the coal, with the weight on top, would arch, so that it was almost impossible to get these lumps out. That condition was overcome after a while, but I will not attempt to say how. I do want to say, however, that I put this question to them—"Why do you not use grabs?" They said they could not, and I insisted that they could. They kept at it, and I understand now that they have overcome the difficulty and are able to use grabs. The same ship is now taking its coal from the bottom, it is not dug out at the top, and the higher space is available for coal. They have conquered in the use of the grab buckets for Welch coal.

I should like to know, in this instance, as to whether that danger of archng of lumps to prevent its running out occurs, and if it does, how they master it.

Mr. Main: Mr. Miller is quite right. In looking at the ship I found that the arching must have given them considerable trouble. They have rounded holes, about 1½ inches in diameter. The vessel had a heating device for thawing this ore out. They have a thawing device throughout the bottom of the ship over each of these wells.

A Visit to the Lakes.

John Reid: As a new member I am a little diffident about appearing so often before you, but this is a subject to which I have given considerable study, and perhaps I can give you a little entertainment in connection with it. In 1899 I came here for a steel firm to investigate the Carnegie arrangements for mining and shipping ore, and I have the most pleasant recollections of the kindness which I received at that time from the Brown Hoisting Co. and the Carnegie Co. on the lakes. When I went to Conneaut, at the suggestion of the Brown Hoisting Co., I saw the first of the hoisting machines, and it was smashed—it was an experimental one, and had broken down. It was thought by some people that it would never be a success, but that if it was a success, it would be the machine of the day. In seeing the machine smashed, and the ship placed, I saw this section, not illustrated in the paper, close to the hatches, and with the large machine swiveling around, it was evident if the machine was to be a success, the design of the ship would have to be changed. I immediately reported to my people, and I said—that if they use these peculiar clam shells, they must put in a bulkhead to hold the ore up, to leave the cargo hold all open, with some form of hatch covering, which need not be mentioned at present, and big arch beams. That was in 1899, and that arrangement was patented by my friends, without my advice in the United States, and they thought they would get a cinch on the lake shipping, but they did not. Wolvin, in 1904, came out with this arrangement of hopper sides and later this was changed to this form (illustrating) which I think is about as perfect as possible. In fact, the whole operation by which the ore is mined, shipped and carried is a most remarkable series of operations, perhaps the most remarkable series of operations of cargo handling in the world.

Suggested Changes in Design.

I think, however, if this hopper side was carried right up to the spar deck in the line of the present hopper, that the structural character of the ship would be greatly improved, with a considerable increase in strength, with a girder running fore and aft; and fitted on top a series of rolling hatches, so that the hatches might be rolled aside and a much larger space left for the grab, and we would then be able to get the grab away without swiveling. The Hulett machine must swivel around, in order to get the ore out of the hatches. It rather restricts the action of the machine. The unoading of this cargo is a most wonderful sight. I never saw anything personally which surprised me more than this machine. I think the man who designed the machine and worked it up to its present condition of perfection, mastering all the difficulties, is able to do anything. It is the most remarkable machine you can see anywhere in the world.

I am not at all sure that Mr. Sheridan is right, when he says that very little has been done in regard to package freight. That comes in all sizes, but I know on the lakes the package freight has been handled nicely by friction hoist, a shaft running fore and aft along the hatches, and a man standing near the hatch to work the lever.

Peculiarity of Spanish Ore.

I know something about Swedish ore, because I have had to handle it—this ore is blasted out the same as rock is blasted, and you get enormous pieces. You cannot handle it with a grab and you cannot handle Spanish ore like that, as it comes in a peculiar form, and it is so long at sea, coming from Spain, that it gets into a solid mass, and must be broken with a pick. No grab can enter it properly, as it gets consolidated. It is practically impossible under these circumstances to use the grab bucket.

Chairman Capps: Gentlemen, you have heard Mr. Sheridan's paper, and the additional information which we have received in the discussion; I am sure that you will all agree with me in extending the thanks of the society to Mr. Sheridan for his valuable paper.

Parker H. Kimball: Mr. Chairman, it occurred to me, not as a discussion on Mr. Sheridan's paper, but as a matter of information to those interested in the subject of automatic handling of ore, that within the past few months there was a paper presented before the American Institute of Electrical Engineers giving the power curves for the Hulett unloader, in unloading ore at Gary, and it occurred to me that the members might like to know where to get the power data.

Structural Rules for Ships.

James Donald's paper on "Structural Rules for Ships" was then read by E. H. Rigg. In 1907 the United States Standard Association through its chief surveyor, Sinclair Stuart, proposed that amendments to the existing rules of the association should be drawn up. A committee was appointed and Mr. Donald was delegated to prepare a new set of rules. Unfortunately before they could be approved, Mr. Stuart died. In order that the work might not be lost, Mr. Donald thought it wise to submit the rules in the form of the paper to the society. Mr. Rigg in abstracting Mr. Donald's paper said:

The idea of the second section is to try to subdivide vessels likely to be built in the United States into suitable divisions for readily obtaining the necessary scantlings, etc., suitable to every trade.

In section 3 an attempt has been made to draw up a table of draft, or free board, which would meet the re-

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quirements of designers without necessarily having the force of laws. An attempt has been made to cut down the cumberstone numerals with which we have all been familiar. This has been done by using a compensating numeral, which appears to have been first advanced by James Winshurst in the summer of 1898. He was the surveyor for the British Board of Trade for many years.

There is another table, on which considerable labor was expended, and that is table 18, for frames. It is arranged in a very brief form. I think for practical work you will find that table is about as concise as it could be. The idea has been, instead of putting the scantlings down indefinitely, to simply put in the beams of the vessel, and go right or left, according to the beam spacing.

As you all know, the big registering societies have been bringing their rules up to date. Lloyds new rules this year are a complete revision and you are all familiar with them.

Communication of George Simpson.

Geo. Simpson (communicated): The rules presented by Mr. Donald, as far as their arrangement is concerned, are certainly much more simple of application than those connected with the various classification socities with which we are familiar. It is, of course, absolutely impossible for one to express an opinion of the suitability of these rules for the various types of vessels considered without first making a careful comparative analysis of the scantlings proposed with those of one or other of the standard registers. Such an analysis would be highly interesting, taking for example typical steamers of each of the types and on the usual assumptions discovering their comparative topside strength. As the time at the disposition of the members of this society has been too restricted for this to be done I thought it might be interesting as a temporary substitute to prepare the attached table giving the scantlings in parallel columns of a typical single deck freight vessel, these scantlings being taken out to the various classification societies' requirements and compared with the rules proposed by Mr. Donald. The scantlings embodied in this table for topside tanks, may be ignored as these you will observe are common to all of the rule requirements. At the foot of each column I have given the weight of each longitudinal idea of the weight involved in building a typical cargo vessel to the various rules. As the weight factor is the most important from both the ship owner's and the ship builder's standpoint, it would be the determining one in adopting scantlings where a vessel was intended for classification. It will be seen from this comparison that a vessel of this type built to the proposed rules would be almost similar in weight compared with the requirements of any of the classification societies compared in the table. Of course, time permitting, it might be shown, although of this I am not sure, that in larger or smaller vessels a different result might obtain.

I should like to express my approval of the methodical manner in which these rules have been prepared and the interest which any discussion on a subject of this kind must create amongst naval architects, as I think it will be conceded that the existing rules at the disposal of our ship owners and ship builders desiring American classification for their vessels requre very much modernizing and bringing up to date in view of the many structural innovations which have taken place within the past ten years, the appearance of many new types, and the scientific investigations into structural strength which have taken place in the same period.

Tribute to President Bowles.

Edwin A. Stevens then presented the following resolution:

Resolved, That the Society desires to place on record its regrets that the President was compelled to be absent from this meeting, and it further desires to express its great appreciation of the work he has done for its advancement since its first meeting 16 years ago; also that it is the sense of this meeting, that a committee be appointed by the chairman to prepare and present a more formal and complete recognition of his services, at the next meeting, which it is earnestly hoped he will attend.

After Admiral Capps, who was closely associated with Admiral Bowles in the early days of the society had spoken feelingly of Admiral Bowles' services the resolution was unanimously adopted.

Strength of Watertight Bulkheads.

Through some extraordinary misunderstanding the New York *Evening Post* was led to announce that the council had withdrawn Commodore William Hovgaard's paper on the "Strength of Watertight Bulkheads" from the proceedings. This was a palpable error but nevertheless chairman Taylor was careful to convey his regret to Commodore Hovgaard that such a stupid blunder should have been made. The paper is one of great value and, in the light of the Republic's recent loss, especially pertinent. At the conclusion of the reading of his paper Commodore Hovgaard said:

"This must be regarded as the first installment, as it has not been possible for me to carry the second part as far as necessary because I have not had available as many tests as I could wish for the analysis. I have had a great number of tests of the double stiffener type of bulkheads, but very few of the single stiffener type, because they have not come into use in the United States Navy until recently. I think when more tests of various forms of single stiffeners are at hand, it will be then possible to frame a simple and reliable formula which can be used with perfect safety in predicating the strength of bulkheads, and in constructing the system of stiffeners to fulfill the requirements."

Discussion on Prof. Hovgaard's Paper.

Prof. Herbert C. Sadler: I think the society should thank Prof. Hovgaard for bringing this matter before us. The subject of the subdivision of ships is one of great importance, and I think we all realize it. It divides itself, I think, into two parts, the consideration of the number of subdivisions we ought to put into a ship, and the consideration of the structural details of the bulkhead.

The question of the number of compartments has been dealt with very fully in the report which Prof. Hovgaard mentions, and it is a matter of simple calculation to decide how many compartments are necessary to fulfill any given conditions as to the vessel being capable of remaining afloat with a certain number of compartments flooded. It is almost impracticable to design the average merchant ship so that she will remain afloat with certain compartments flooded. If we divide a vessel up so she will remain afloat with all compartments flooded she becomes impractical so far as handling cargo is concerned. The question of the structure of the bulkheads ought to be such, that, when a vessel is damaged and a compartment flooded, the vessel will remain afloat with that compartment flooded, and the bulkhead will not give way. The case

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that Prof. Hovgaard mentions I think emphasizes this fact very strongly—so that really the structure of the bulkhead is perhaps of more importance than the number of bulkheads. In passenger vessels, of course, we can design them to float with any two or three compartments flooded, but it is practically useless to do so, if the bulkheads are going to give way when under load. I think that is the keynote of Prof. Hovgaard's paper.

With regard to the general treatment of bulkheads, I fully agree with Prof. Hovgaard that it is a useless thing to put stiffness on both sides. There is no particular point in it, it may be a little simpler, but I think in general we can get all the stiffness we want by putting the stiffeners on one side of the bulkhead, and so getting the benefit of the bulkhead plate itself.

I am sorry I have not had time to look over the mathematical treatment of the subject in detail, but from a casual glance at it I think as far as I can see the method is original. I do not remember ever having seen quite the same treatment before, and Prof. Hovgaard is to be congratulated on this elemental way of treating the subject.

The Steamboat Inspection Service.

There is, however, one other point to which I would like to draw attention. This morning the question as to whether this Society could appoint a committee to consider the question of the merchant marine was discussed. As far as I am aware, this Society is not represented in any of the discussions in connection with the steamboat inspection service. As far as I am aware, we have not any standing committee that is called in when questions of a technical nature are being discussed by the Steamboat Inspection Service. I think it is a mistake. This Society should represent the best available technical knowledge in the country, and it seems to me absurd that this Society should not be represented when technical questions are being discussed in connection with steamboat work. I have had that brought home to me, and I suppose all of you have had, in connection with some of the requirements, and particularly the requirements for bulkheads. If you will look at the rules, you will find that the Steamboat Inspection Service will not allow you to put a stiffener on a bulkhead less than 3.5 x 3.5 in. That is their rule. Now, suppose you have a somewhat lightly constructed river steamer, with bulkhead plates ¼ in. thick, probably using about a ⅝-in. rivet, I think you will all agree with me that a little ⅝-in. rivet on a 3.5 flange looks somewhat foolish, to say the least, but we have to put in this 3.5-in. flange to take a ⅝-in. rivet. Also this other flange is specific, and in some cases there is no doubt that 3 in. might be enough, and in other cases 3.5 in. is not nearly enough. The whole question is left in one case in a rather foolish state, and open to adjustment between the inspector and the builder. I just draw attention to that fact, because, as I say, this comes up in connection with this paper, and I think this is a matter in which this Society should take some interest, not only in connection with bulkheads, perhaps, but with other matters pertaining to shipbuilding generally.

Difficulties of the Ship Builder.

Mr. Main: I would like to remark that this is certainly a valuable paper, but when a naval architect or shipbuilder is called upon by an owner to get at the cost of a new ship, which he sometimes has to do in a period of about 24 hours, and if the vessel is not to be classed by any of the registration societies—and in these days of keen competition it is natural that the shipbuilder will endeavor to design the vessel as light as is consistent with the requirements which the vessel has to fulfill—and of course you can see if he has no data before him it would be quite a problem to take some of these formulae and work them out.

This paper is very valuable, and I would like to see it supplemented by scantlings for bulkheads, and plating, and stiffeners for various depths of hold. I think that would be a fine thing to append to such a paper as this, so any one taking it up could use it readily, and could find the minimum weight of bulkheads to do the required work.

Admiral Bowles used to tell us you can always tell when a ship is too light, but you can never tell when she is too strong. There is no complaint if she is too strong, but when she is too light, you notice it.

Prof. Sadler's remarks are very appropriate, regarding the rules of the Steamboat Inspection Service. These rules, as you know, about a year ago called for bulkhead stiffeners to be spaced not more than 24 in. apart, but salt water seems to have decreased in weight or pressure, and we are now allowed 30 in. If the registration societies are increasing the weight of stiffeners, our laws are decreasing them by spacing them wider. I have not followed the paper closely enough to give you any positive angle at which the horizontal stiffener should be bent, but in one case, with a small bulkhead, the bulkhead bent out 2 in. when the tank was filled. But the bulkhead did not leak. The bulkhead was strong enough to hold the water, but you could hardly send the vessel out in that condition. That bulkhead was effectively stiffened up by putting a horizontal channel one-third of the distance from the base. There is a case where a horizontal stiffener was more useful, and of lighter weight, than increasing all the other stiffeners.

Strains Upon the Bulkhead.

Chairman Stevens: The chair would respectfully suggest the consideration of the strains upon the bulkhead by the blow, even when it does not strike the bulkhead directly. It is probably impossible to formulate mathematically a very satisfactory statement of such stresses, but it would appear that a little practical experience as to the effect with ships that have been struck, not on the bulkhead, but in the neighborhood of the bulkhead, showing how the structure of the bulkhead had stood the effect of the shock, absorbing the energy of the blow, would be of interest. I trust that some of the members who have had practical experience along that line will give us the benefit of any data they may have on the subject.

If there is no further discussion, Prof. Hovgaard will close.

Prof. Hovgaard's Reply.

Prof. Hovgaard: I quite agree with what Prof. Sadler said, that the main point of this bulkhead question is that we should make the bulkhead strong enough—practically irrespective of the question of how many bulkheads there are, we can at least require in the passenger vessel that the bulkheads, when they are called upon to carry the pressure of water, that they should be strong enough, and possess the same margin of strength as does the outer shell of the ship. That seems not to have been the case in the steamship Republic, and I mention that case because it is one we all know about, although we do not yet positively know how it was she went down, but we know that had the bulkheads of that ship been absolutely strong and snug she would have floated, because she floated for the greater part of a day, and had the bulkheads

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been strong enough there is no reason why she should not be floating today.

As to the desirability of giving in such a paper tables for the scantlings, that would no doubt be a very good thing to have, but it has been impossible, as I said before, to get to that practical point yet. I have not got facts enough and tests enough to approach that part of the subject yet, in a satisfactory manner, so I had to limit mself to the theoretical consideration. Of course, on the face of it, that looks somewhat interesting.

It was mentioned that a bulkhead deflected 2 in.—I have seen a bulkhead which deflected 6 in., and although it was not quite water-tight, there was considerable leakage at the seams, still it was not a serious matter, and the ship could easily be kept afloat with the pump. That was in the imperial yacht the Standard built for the Czar of Russia—that bulkhead was strengthened with one or two horizontal stiffeners, I cannot remember which. I think that bulkheads will generally stand a great amount of deflection before they break down, and for a considerable time, and then there will be usually leakage on the seams, and that is a point I have not touched on in this paper, and leakage along the seams in a large bulkhead may become a serious matter, and the pumps may not be able to keep the vessel afloat.

Chairman Stevens: Was not that the cause of the loss of the Republic?

The Case of the Republic.

Prof. Hovgaard: In the Republic that seemed to be the case; there was a great deal of leakage; the ship sank deeper and deeper. When the relief vessels came, she was 6 ft. by the stern, and, of course, the height of the water in the compartments was thus very much increased, and the pressure on the bulkheads was very great indeed.

Chairman Stevens: I believe the chief engineer of the Republic stated that one good steam pump would have saved the ship if he could have kept it going.

Prof. Hovgaard: Quite possible. I wish there was some one here who could give further data on the loss of the Republic. I was hoping some one would come forward and discuss this point.

Chairman Taylor: The thanks of the Society are certainly due to Prof. Hovgaard for the paper, the value of which will probably grow greater and greater as time extends, and that is really the true measure of the value of a production of this nature.

E. T. Keyser's paper on "The Development of the Gasoline Power Boat" and James H. Warrington's paper on "A System of Mathematical Lines for Ships" were read by title only.

The New Westinghouse Marine Steam Turbine Drive

THE November MARINE REVIEW contained the first description of the Melville-Macalpine reduction gear appearing in any American publication. We present herewith a description of the hydraulic brake devised for testing out the gear.

Although the apparatus was designed primarily for marine use in order to permit of the use of a high speed turbine in conjunction with a moderate or low-speed propeller, it should be equally applicable in other cases where a positive and compact connection between the prime mover and the driven apparatus is desired. Incidentally while permitting of the use of positively connected turbines and propellers, each running at its most efficient speed, it also makes for a substantial reduction in space and in weight, the latter not only in itself but in reduction in fuel carried due to the higher economy attainable by reason of taking fullest advantage of rotor speeds nad steam velocities. A most complete series of tests were undertaken by the Westinghouse Machine Co., East Pittsburg, Pa., builders of the gear, in order to determine its capacity and efficiency and in order to do so it was necessary to provide some form of brake or dynamometer that would be capable of absorbing a continuous output of 6,000 effective horsepower, and the following particulars of this brake and of the tests conducted therewith are from information supplied by the Westinghouse Co.

A brake of this capacity was in its way as entirely unprecedented as the gear itself. In any form of mechanical brake, the energy is transformed into heat, and in dealing with such large powers as were contemplated, the problem of carrying away the heat generated becomes a very serious one.

An ordinary band or "Prony" type of friction brake was entirely out of consideration, as the speed would limit the diameter of the brake wheel to 6 or 7 ft., and its face would have to be not less than 30 ft. The difficulties involved in the construction, and the cooling of such a brake, and the maintenance of the proper tension on a brake band of this width are practically insurmountable.

For a number of years, the Westinghouse Machine Co. has successfully employed a form of hydraulic brake for measuring the power developed in the works tests made on all steam turbines manufactured by it. This form of brake consists of a rotor mounted on a shaft coupled to the shaft of the turbine, and rotating within a closed casing supported on journals through which the rotor shaft passes. The casing is held against turning by means of a radial arm bearing against a vertical strut, the lower end of which rests on an ordinary platform scale. Within the casing is a quantity of water, which quantity may be maintained constant at any desired amount by means of inlet and outlet pipes with adjustable controlling valves. The rotor has a series of vanes or teeth on its periphery which tend to impart a rotary motion to the water contained in the casing. The inner surface of the casing is provided with vanes or teeth which resist this tendency, and the result is a powerful braking action, the intensity of which can be regulated by the quantity of water in the casing. The resistance which the casing must offer to prevent its being rotated by the water striking its inwardly projecting vanes at high velocity is measured by the pressure exerted on the platform scale by the strut under the radius arm, and from this pressure, the effective length of the radius arm, and the number of revolutions per minute, the power is calculated in identically the same manner as in the case of an ordinary Prony or band brake. As a matter of course, the temperature of the water is quickly raised to the boiling point, and a considerable portion of it evaporates, and in the form of steam easily carries off the enormous quantities of heat generated. The amount of fresh water admitted to compensate

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for the quantity lost by evaporation and through the overflow pipes, is constantly adjusted by the attendant in such a way as to keep the scale at all times in perfect balance.

Fig. 1 is a general view of the turbine, the reduction gear, the dynamometer and the arrangements for weighing the load. On account of the heavy pressures to be dealt with, the resistance of the radius arm is not taken up directly on the platform of the scale, but is transmitted through a knife edge bearing to an I-beam, one end of which rests on a solid foundation and the other end on the platform of the scale. The I-beam also rests on knife edge bearings at either end, and forms a lever of such proportions that only one-fourth of the total stress comes on the scale. At the top of the dynamometer will be seen the flexible hose pipe connections for admitting the water to the interior of the casing.

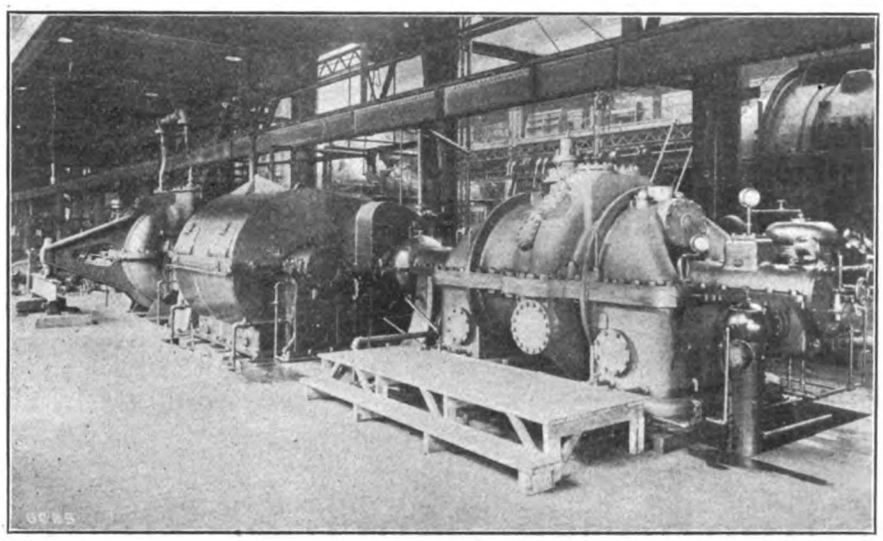

FIG. 1.

Fig. 3 is a view of the interior of the upper half of the casing, and shows the stationary vanes which resist the impulse imparted to the water by the rotor. These vanes are inserted and supported in precisely the same manner as the blades in the cylinder of a steam turbine.

Figs. 4 and 5 are two views of the rotor, bladed with regular steam turbine blading sections, the rows on one side of the center being of what is called "right hand section" and on the opposite side of "left hand section."

The water enters the top half of the casing through ports on either side which register with the passages in the side of the rotor clearly shown in Fig. 4, just inside the rim. Through these passages the water is carried to the middle of the rim of the rotor and is discharged through the ports shown in Fig. 5, between the two innermost rows of blades.

With the aid of the diagram, Fig. 6, a developed cross section through the blades, the action that next takes place will be readily understood. The moving blades are shown in solid and the stationary blades in cross-lined section. The water emerges with a whirling motion from the port A, and immediately meets the broad central row of stationary vanes which check its angular velocity. It escapes to the right and left from the passages between the central row of stationary vanes and is picked up by the first row of moving blades on either side. These moving blades again impart a high angular velocity to the water, and by reason of the curvature of their section project it into the adjacent rows of stationary vanes, where the velocity is again checked. This action is repeated as the water passes through the successive rows of moving and stationary blades, until it reaches the outermost rows of moving blades.

From these last rows of moving blades the water is projected into circumferential passages of semi-circular cross section in either end of the casing.

These passages are shown at B in Fig. 7, a partial cross sectional view through the rotor and casing. At intervals in these circumferential passages are baffles to again check the angular velocity of the water. These baffles are shown plainly in Fig. 3, inside view of upper half of casing. The passages in the casing re-direct the water into the rotor—or at least so much of it as has not been already evaporated—and the entire cycle of operation is repeated indefinitely.

Fig. 8 is a section through the assembled dynamometer. The passages through which the water enters are indicated by the letters C and C'. D and D' are vents for the escape of the steam generated by the transformation of the mechanical energy into heat. It is not practical to carry off all of the heat by evaporation alone, as the generation of 15,000 lbs. of steam per hour in the casing would cause such a violent boiling as to interfere with the stability of the braking action. Consequently the quantity of water admitted into the casing is considerably in excess of the quantity evaporated, and the surplus is discharged at boiling temperature through the passages E and E'.

The dynamometer measures the output of the gear with the utmost precision, but in order to determine the transmission loss, it is imperative that the input should also be known. An extensive series of tests was carried out in which the power was measured by a dynamometer attached directly to the shaft of the turbine. It was found that for each speed and load, with a constant vacuum and with steam of uniform quality, there was a corresponding inlet steam pressure. By often repeated trials it was found that by reproducing any particular set of conditions of speed, inlet pressure and vacuum, the brake load could be predicted with unfailing accuracy.

The dynamometer, notwithstanding that it was an entirely new creation, has operated in the most gratifying manner as regards steadiness, sensitiveness, and capacity, and in general has creditably upheld its part in what is perhaps the most extensive laboratory experiment that has ever been undertaken and carried out by strictly private enterprise.

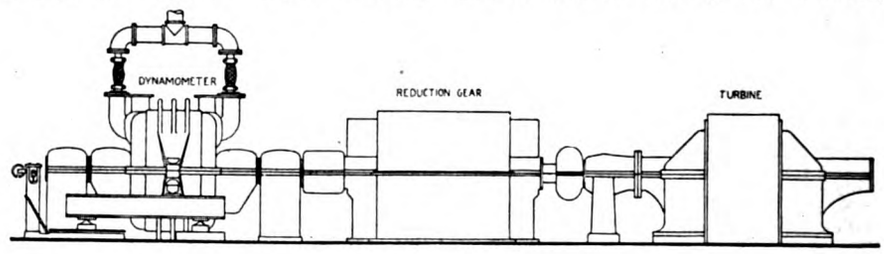

FIG. 2.

When the Melville and Macalpine experimental reduction gear was first erect-

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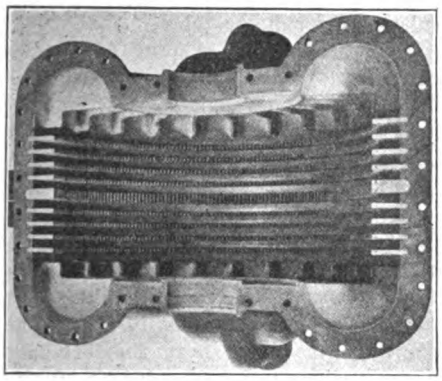

FIG. 3.

ed and started on Sept. 7, 1909, extensive preparations had been made to determine the efficiency of the apparatus on the assumption that there might be a transmission loss of at least 5 per cent. After calculating the results of a few preliminary trials, it was found that the apparent efficiency was over 98 per cent, and this raised the perplexing question as to how to determine this unexpectedly small transmission loss with a satisfying degree of exactitude.

If the efficiency were only from 90 to 95 per cent, its measurement, within reasonable limits of accuracy, would have been an easy matter. Rising as it unquestionably does, above 98½ per cent, it will be readily understood that the problem requires a refinement of method, and a degree of painstaking care far beyond that which is usual in ordinary engineering investigations.

For the reason that the efficiency is so remarkable, it has been thought advisable to describe the methods employed and to tabulate the principal observations with a minuteness of detail that might, in many cases, be considered superfluous, if not actually wearying.

Naturally the first trials of the gear were made at very moderate speeds and loads, with frequent stops to examine the condition of the teeth and bearings. During the first few days the speed was gradually raised to 1,500 R. P. M. of the turbine shaft, and 300 revolutions of the gear shaft, and a load of over 6,000 B. H. P. was carried. The load was limited only by the power of the turbine, as there were no indications that the ultimate safe capacity of the gear had from any standpoint been nearly approached.

On Saturday, Oct. 16, 1909, an endurance test at maximum load and speed was started at 3:15 p. m., and continued until 7:15 a. m. on the following Monday, or a total of 40 hours. This test was witnessed by Commander R. S. Griffin, U. S. N., and Lieut.-Commander U. T. Holmes, U. S. N., specially delegated for this purpose by the Bureau of Steam Engineering of the United States Navy Department.

The load was applied by the hydraulic dynamometer, described on the preceding pages. The radius arm of this dynamometer is 6½ ft., and the pressure exerted is transmitted to the platform scale through a lever having a ratio of approximately 1 to 4, as shown in Figs. 1 and 2 in the detailed description of this piece of apparatus. The precise distances between the knife edges on the lever being, however, 18 in. and 72 5-32 in. respectively, the effective length of the radius arm of the dynamometer is

$$\frac{6.5 \times 72.15625}{18} = 26.056 \text{ feet.}$$

The constant for 1 lb. pressure on the scale, and 1 R. P. M. is consequently

$$\frac{26.056 \times 2 \times 3.1416}{33000} = 0.0049612 \text{ horsepower.}$$

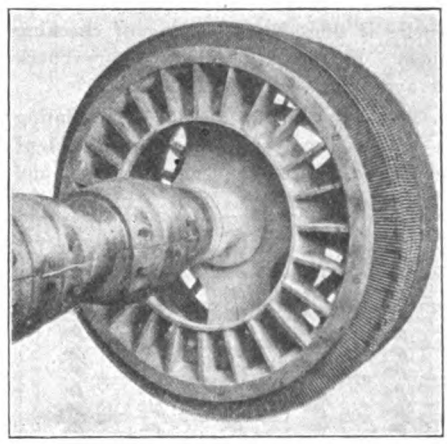

FIG. 4.

During this trial the following average conditions were maintained:

Gross weight on scale, lbs.	4443.4
Dead weight on scale, lbs.	388.0
Net weight on scale, lbs.	4055.4
Speed, R. P. M.	300.6
B. H. P.	6048.0

With the dynamometer the measurement of the power output of the gear becomes a very simple matter. But to determine at the same time the effective power input, is an engineering problem that is more than a little out of the ordinary. If the gear were driven with a reciprocating engine, the natural procedure would be to measure the indicated horsepower, and either estimate or measure the friction of the engine, and thus obtain a correction which, when applied to the indicated horsepower, would give the effective power delivered to the gear.

There being no way in which to measure the indicated horsepower of a steam turbine, it became necessary to establish the exact brake horsepower in some other way. Happily, there is one characteristic of the steam turbine that makes it possible to calibrate any particular machine, in such a way that its output in effective horsepower at any instant may be determined with greater accuracy than it is possible to determine even the indicated horsepower of a reciprocating engine. As long as the speed and exhaust pressure are maintained constant, the absolute inlet pressure of commercially dry steam, at any instant, is a very accurate measure of the brake horsepower the turbine is developing

By substituting for the reduction gear, a dynamometer connected directly to the turbine shaft, and operating the turbine at a fixed speed and with a constant vacuum in the exhaust pipe, we may determine the inlet pressures corresponding to different loads at this speed.

Plotting these observations on a diagram in which the ordinates represent absolute pressures per sq. in., and the abscissae represent brake horsepowers, and drawing a line through the several points, we get a scale by means of which the horsepower corresponding to any inlet pressure may easily be read. This line is practically straight, so that readings made between the points representing actual observations, are quite dependable.

The diagram in Fig. 9 shows the calibration of the turbine used on these tests at 1,500 R. P. M. with a vacuum of 22.78 in., corrected to a barometric pressure of 30 in.

The radius arm of the high speed hydraulic dynamometer used in calibrating the turbine is 48.375 in. The constant per pound pressure on the scale is therefore

$$\frac{48.375 \times 2 \times 3.1416 \times 1500}{12 \times 33000} = 1.1513$$

TABLE I.

Inlet Pressure Absolute.	Gross Weight on Scale.	Dead Weight on Scale.	Net Weight on Scale.	Brake Horsepower.
109.6	3,585	385	3,200	3,675
114.8	3,755	385	3,370	3,880
119.3	3,925	385	3,540	4,076
124.3	4,095	385	3,710	4,271
128.8	4,265	385	3,880	4,467
133.3	4,435	385	4,050	4,663
139.3	4,690	385	4,305	4,956
143.8	4,860	385	4,475	5,152
147.3	5,030	385	4,645	5,348
151.8	5,200	385	4,815	5,543
157.8	5,455	385	5,070	5,837

Table I gives the observed absolute inlet pressures, loads on scale, and calculated brake horsepowers over a considerable range above and below 5,000 H P. From these observations and calculations, a calibration curve similar to that shown in Fig. 9, was drawn to a large scale so that small differences of loads and pressure could be read accurately.

In these tests, as well as in the turbine calibrations, at every load before reading the inlet pressure, the speed of the turbine was brought exactly to 1,500 R. P. M., as indicated by a vibration

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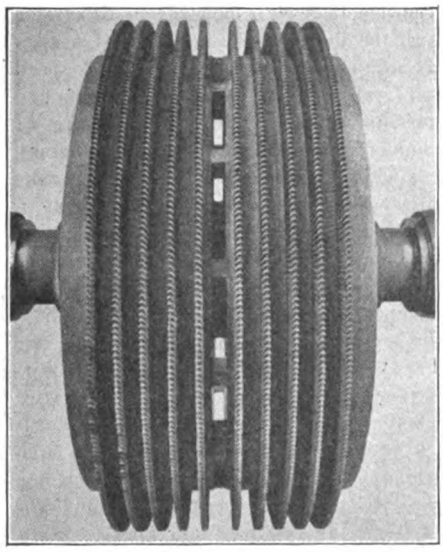

FIG. 5.

tachometer, and the vacuum adjusted to exactly 22.78 in. corrected to a barometric pressure of 30 in. The vacuum was purposely carried abnormally low by bleeding a small quantity of air into the exhaust pipe. By means of a small valve in the air inlet pipe, the vacuum could be quickly and accurately adjusted to the arbitrary standard without its being necessary to make any change in the speed of the air pump or the quantity of the circulating water.

The gear and pinion having respectively 176 and 35 teeth, the speed of the driven shaft would be 298.3 R. P. M. The horsepower constant of the dynamometer is, as stated above, 0.0049612.

In Table II, column 1, are the observed absolute inlet pressures corresponding to the different loads transmitted through the gear as set down in column 5. In column 6 are given the horsepowers of the turbine alone corresponding to the same inlet pressures, as determined from the calibration curve. Obviously, the quantities in column 5 represent the power output of the gear, and those in column 6 represent the power input. The quantity in column 5, divided by the quantity standing against it in column 6, gives the efficiency as it appears in column 7.

TABLE II.

Inlet Pressure Absolute.	Gross Weight on Scale.	Dead Weight on Scale.	Net Weight on Scale.	Brake H. P. Delivered by Gear.	Brake H. P. of Turbine from Calibration Curve.	Efficiency.
111.8	2,900	388	2,512	3,712	3,771	98.7
122.3	3,200	388	2,812	4,156	4,197	99.0
132.3	3,480	388	3,092	4,576	4,623	98.9
142.3	3,791	388	3,403	5,036	5,108	98.7
152.3	4,100	388	3,712	5,486	5,567	98.5
162.3	4,400	388	4,012	5,927	6,057	98.7

In spite of the fact that the greatest precautions were taken to insure accuracy, the readings being checked by several observers, and the gages and scales being standardized before and after each trial, one would feel some hesitation in vouching for these efficiencies if there were no way of checking them. Fortunately, a satisfactory check is available.

The gear is lubricated by circulating a copious supply of oil under a head of about 10 lbs., through the bearings, and through a spray which plays continuously on the teeth of the wheels. The transmission loss in the gear therefore appears as heat in the oil. The heated oil coming from the gear is passed through a cooler which is very like a surface condenser with cold water circulating through the tubes.

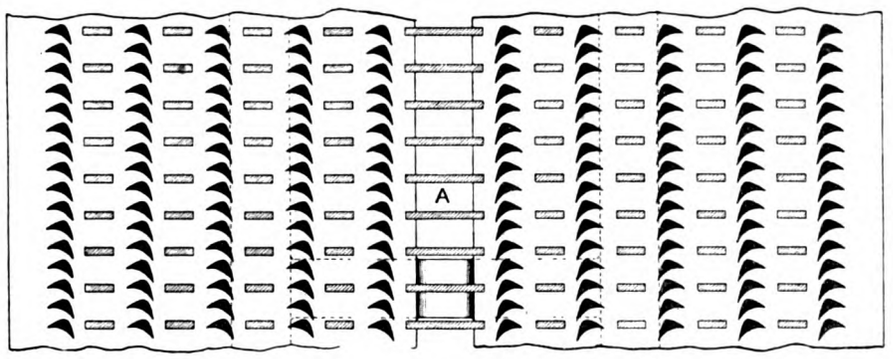

FIG. 6.

By measuring the quantity of oil circulated and noting the rise in temperature in passing through the gear, a close approximation of the number of British Thermal Units lost per hour in friction is obtainable.

At a load of 5,088 H. P. delivered by the gear, 591 lbs. of oil were circulated per minute, with an average rise in temperature of 9.86 degrees Fahr. The specific heat of this oil is 0.47, and consequently the total heat absorbed per hour is $591 \times 0.47 \times 60 = 164{,}208$ B. T. U.

As 2,545 B. T. U. per hour is the equivalent of a horsepower, the total heat accounted for in the oil is

$$\frac{164{,}208}{2{,}545} = 64.17 \text{ B. H. P.}$$

The brake horsepower being 5,088, and 64.17 horsepower being accounted for by the heat in the oil, the efficiency by this method of calculation would be

$$\frac{5{,}088}{5{,}088 + 64.17} = 98.75 \text{ per cent.}$$

This figure is probably a little too high, as there is an indeterminate small quantity of heat radiated from the gear casing and from the oil piping that has not been accounted for. Even if this were 20 per cent of that accounted for, which is most improbable, the efficiency indicated would still be 98.5 per cent.

The gear having thus demonstrated the soundness of the judgment of its designers in all respects except as experience is to be gained by more extended actual service at sea, Mr. Westinghouse has designed a turbine especially for marine use in connection with the Melville and Macalpine reduction gear, and a half-tone view of the complete unit is presented herewith. Fig. 10.

The illustration shows a design for a 600-H. P. unit which will weigh about 90,000 lbs., or 15 lbs. per H. P. In larger units the weight will be reduced to approximately 12 lbs. per H. P.

Mr. Westinghouse says in reference to this design:

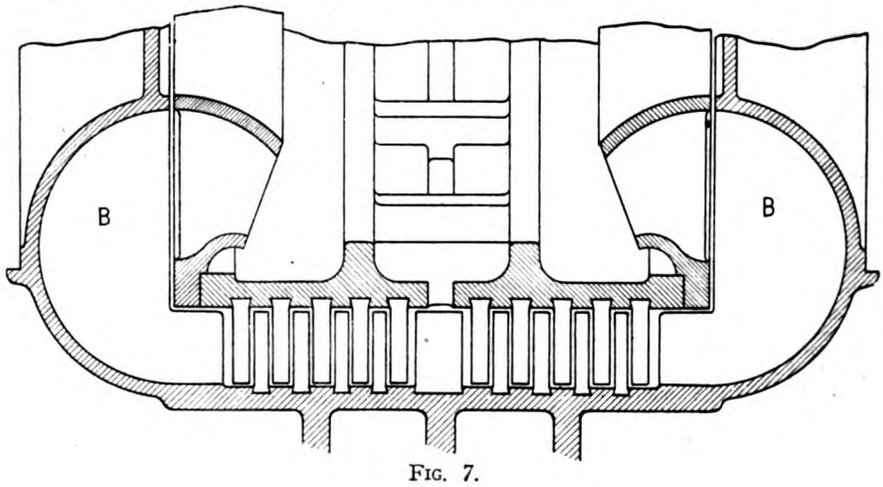

FIG. 7.

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The New Westinghouse Marine Steam Turbine Drive.

In designing a steam turbine to be used in connection with the Melville and Macalpine reduction gear for marine propulsion, I have avoided the introduction of any untried or experimental

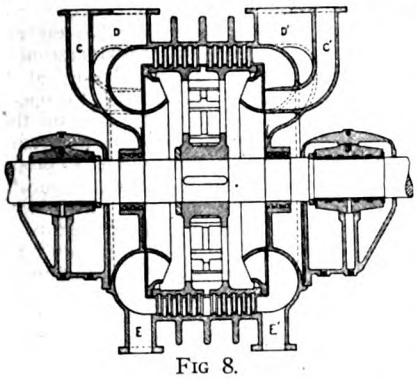

FIG 8.

features. While the machine as a whole is novel, it will be found on analysis that it is made up of elements that have thoroughly proven their practicability and reliability.

It is not necessary for me to touch on the question of steam economy; this is purely a matter of the right proportioning of the blades, nozzles and other steam passages. I am sure that no one who has a reasonable acquaintance with the turbine work carried out by the Westinghouse Machine Co. over a period of 15 years, will question the ability of the engineering staff at my disposal, to care for this detail in a thoroughly satisfactory manner. The inherent economic possibilities of the turbine I propose are, by reason of its higher rotative speed, markedly greater than those of a turbine limited in its speed on account of being directly coupled to the propeller, and these possibilities will be utilized to the fullest extent.

The features I wish to emphasize at present are not based on theoretical considerations, but are purely mechanical features which have to do with the simplicity and adaptability, the accessibility, and the method of control.

Simplicity and Adaptability.

Each turbine is a complete independent unit, with the high pressure and low pressure ahead and astern turbines in one casing. There is no complicated tangle of piping; a single pipe brings the high pressure steam to the turbine, and a single direct exhaust connection to the condenser suffices for the astern as well as the ahead turbine, the exhaust from both sections communicating with each other through the hollow rotor.

The comparatively high rotative speed reduces the number of rows of blades necessary to efficiently utilize the energy in the steam, and the number is still further reduced by making the first and largest pressure drop through a single impulse wheel, instead of through a number of rows of blades of the reaction or "Parsons" type. When the steam has expanded to a considerable volume it is handled more efficiently by blading of the latter type, but in the earlier stages of the expansion, when the pressures are high and the volumes comparatively small, the energy is extracted with a properly designed impulse wheel just as efficiently as it could be with many rows of "Parsons" type blades. The greater compactness, due to the use of the impulse wheel, is a most valuable feature in a turbine for installation on board ship. With this construction, the distance between the bearings becomes short, and the rotor is consequently very stiff, and has practically no tendency to set up vibrations which are not only annoying, but which necessitate wasteful clearances in order to avoid injury to the blading due to contact with the cylinder or the rotor.

Another advantage of using the impulse wheel for the earlier stages of the expansion is that the high pressure steam at high temperature is confined to the nozzle chambers, so that the range of temperature and pressure to which the casing of the turbine is subjected, is much reduced and consequently there is less tendency for the casing to distort.

The ahead and astern turbines have impulse elements of the same size, but in the latter the complement of reaction blading is less. The power available for going astern is, however, unusually liberal, and the economy is sacrificed in a much smaller degree than is usual in marine turbine installations. Furthermore, all of the propellers are available for going astern, which is a decided

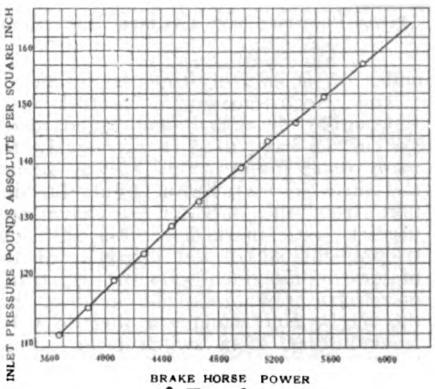

FIG. 9.

advantage not commonly met with in existing turbine-propelled ships.

The impulse wheels have two sets of blade passages arranged concentrically, the outer annulus being considerably narrower than the inner one. When the turbine is working at low power, one or two nozzles may be opened which discharge on the outer or smaller blade ring. For greater power one or two larger nozzles may be opened to discharge against the inner or larger blade ring. For maximum power, all of the nozzles and both blade rings are brought into action. The nozzles are so proportioned, and can be operated in so many different combinations that the entire range from minimum to maximum power may be covered in convenient steps without throttling the pressure in the nozzle chamber. In other words, the full expansive energy of the steam is available even when the vessel is running at the most moderate cruising speed.

Accessibility.

In a marine turbine installation there is probably no single feature worthy of more serious consideration than that of accessibility. Space on shipboard is so valuable that the engine room must be confined within the smallest possible limits, and it is consequently important that every precaution should be taken to design the machinery with especial reference to convenience in dismantling and opening for inspection and repair.

The design which I submit is novel in that all pipe connections are made to the lower half of the casing. The cover may therefore be lifted or swung back on hinges, without breaking a single pipe joint.

The most valuable improvement, however, is in the design of the cylinder blading. In all other turbines of the Parsons type, it is necessary to remove the rotor in order that access may be had to the blades of the lower half of the cylinder. The removal of the rotor of a large turbine is at best a laborious and tedious undertaking and is attended with considerable risk of damage to the blading. On board ship, by reason of the congestion that exists even in the most liberally proportioned engine rooms, the difficulties are multiplied. Furthermore, the time required for making inspections and repairs is often a factor, the importance of which it is difficult to overestimate.

I have perfected a design of cylinder blading in which the blades are mounted on flexible bronze strips instead of being calked into grooves in the cylinder. The cylinder grooves are made much wider and deeper than usual, and are slightly undercut, leaving overhanging shoulders near the top. These blade strips may be slipped into the grooves where they cut through into the cylinder flanges, and light springs underneath hold them up

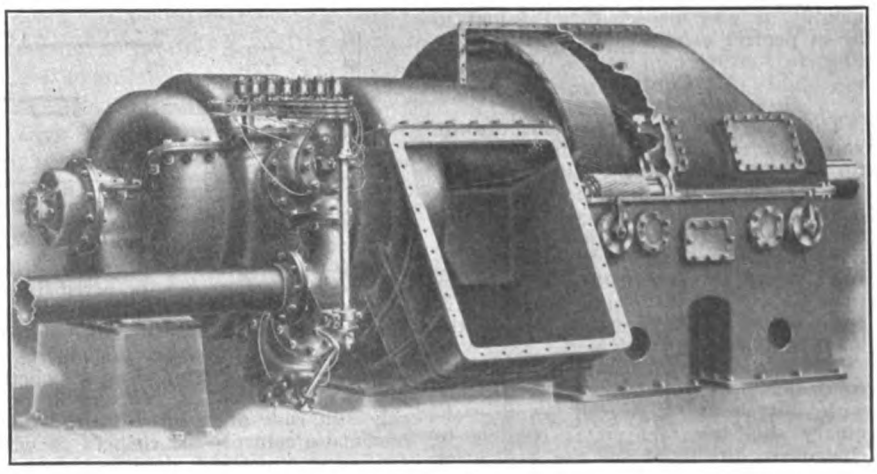

FIG. 10.

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against the overhanging shoulders. With this design the entire cylinder blading can easily be removed and replaced without unseating the rotor. An entire spare set of blading can be stowed in a small space and in case of necessity repairs could readily be made at sea, by the engineering staff in an incredibly short period of time.

The bases of these blading strips are extended on one side so that they project over the tips of the corresponding rows of blades in the rotor, forming what is practically a removable bronze lining for the cast iron cylinder. As the blade strips are backed up by flexible springs, the clearances between the tips of the blades and the cylinder or the rotor may be reduced to a minimum that would be impossible with rigidly inserted blading, as the yielding base strips prevent any rubbing contact that would be intense enough to bend or distort the blades. Indeed, I have found it practicable to assemble the turbine with the blade tips in actual contact with the base strips and the rotor and to allow the clearance to adjust itself by actual wear. This is, of course, the ideal method of getting the smallest possible clearance, and reducing the leakage past the blade tips to the lowest limit.

The practicability of this blading has been thoroughly demonstrated by actual trial in a turbine of over 20,000 H. P. capacity which has been in operation since April, 1908. As late as the first week in September, 1909, or after the blading had been in service over 17 months, it was inspected and found to be in perfect condition.

Control.

There are two independent throttle valves on each unit, one for the ahead turbine and one for the astern turbine. These valves are operated by simple levers, and are so designed that a continuous movement of either operating lever from the closed position, opens successively all of the different combinations of nozzles, admitting the steam in constantly increasing quantities until the maximum power is attained.

While the turbine may be manually controlled by the engineer in accordance with instructions conveyed by the ordinary ship telegraph, it is possible to control it directly from the bridge or from any one of several points on the vessel by means of an electro-pneumatic operating gear working on the throttle valve levers.

There are doubtless emergencies in which the small fraction of time saved by making the signal to the engineer on watch actually perform the desired operation in the engine room, would be well worth saving. Again, in case of the steering gear becoming disabled, steering with the screws would be particularly convenient and efficient, with the speed and direction of the engines under direct control from the bridge.

This electro-pneumatic control is a thoroughly developed and standardized system. I have used it extensively for many years for operating railway signals and throwing switches at points far distant from the operator. I have also used it with marked success for controlling the speed and direction of the motors on individual cars of long trains on electric railways. The incident that the mechanism actuates a throttle valve lever instead of a switch lever or the handle on a rheostat, of course, presents no new problem.

Another feature of the electro-pneumatic control system is that the instant the desired action has occurred in the engine room, the fact that it has been accomplished is automatically signalled back to the operator so that there can never be any uncertainty as to whether or not the system is functioning properly. In case of failure of the electro-pneumatic control—the chances of which are very remote—it does not interfere in the smallest degree with the ordinary system of signals and manual control. In short, the electro-pneumatic control is offered not as a substitute, but as a duplicate system.

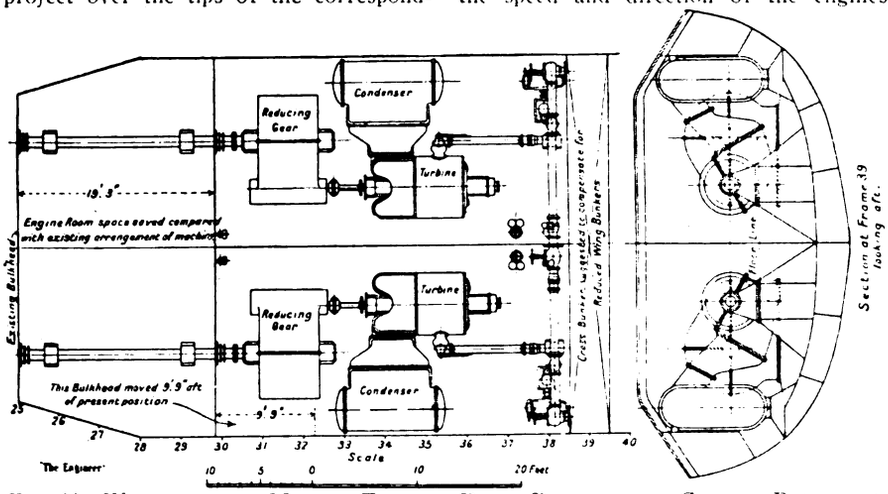

FIG. 11—WESTINGHOUSE MARINE TURBINE DRIVE PROPOSED FOR CRUISER BALTIMORE.

To sum up briefly, the marine steam turbine problem has heretofore been considered almost exclusively from the standpoint of speed and steam consumption. These are purely academic questions, and have already been settled more or less satisfactorily. On my part, I am giving especial consideration to the matter from the standpoint of the staff whose duty it will be to operate such installations, and to maintain them in the highest state of efficiency, and I wish to reiterate that what I propose is only the common sense application of well tried mechanisms, with which I have had an extended and gratifying experience. The especial features I have described are in no wise startling or revolutionary, unless it should be startling and revolutionary to suggest that constructions that have performed certain functions efficiently on land, may efficiently and satisfactorily perform the same identical functions on a ship.

The Westinghouse company have submitted to the navy department plans of a proposed installation of turbine and reduction gear in the United States cruiser Baltimore, and in general the arrangement is as shown in Fig. 11.

The navy department have adopted the new combined turbine and reduction gear for the fleet collier No. 8, building by the Maryland Steel Co., Sparrows Point, Md. The ship is to be fitted with 7,200-H. P. on twin-screws, and the Westinghouse company will install their new marine type turbine, giving an overload capacity of upwards of 8,000 H. P.

The general arrangement of the gear is approximately as shown in Fig. 12, from which its compactness and general convenience will be fully apparent.

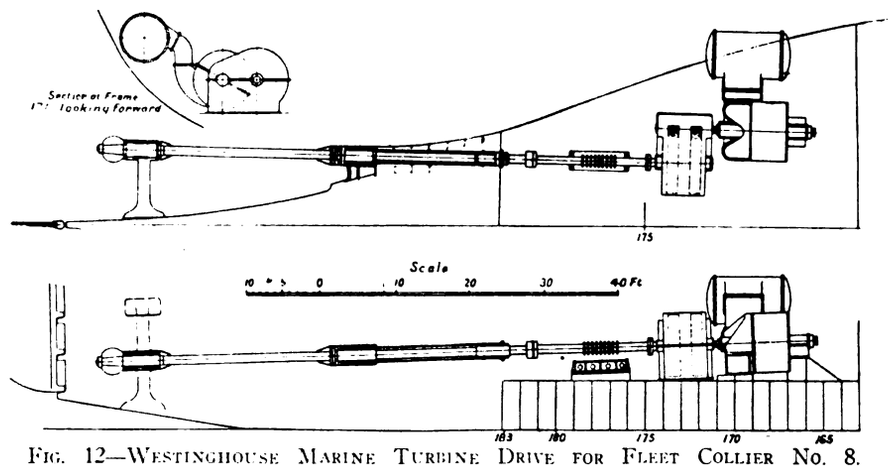

FIG. 12—WESTINGHOUSE MARINE TURBINE DRIVE FOR FLEET COLLIER NO. 8.

The performance of this first actual installation of the new design of turbine and speed reduction gear will be looked forward to with much interest.

The Bruce-Macbeth Engine Co., Cleveland, O., has opened a branch office at 1020 Drexel building, Philadelphia, with M. E. Jackson in charge.

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BOILER EXPLOSION ON THE DESTROYER HOPKINS.

San Francisco, Feb. 15.—Inquiry into the cause of the fatal accident aboard the torpedo boat destroyer Hopkins at San Diego yesterday, nothing official regarding the findings has been made public by the flotilla commander, Lieut. L. J. Richardson.

From the men on the boat it was learned that Fireman R. C. Taylor lost his life and six of his fire-room comrades were severely burned because the boiler room blowers were not running when the defective tube gave way.

Lieut. Fredericks, who commands the Hopkins, said that it was probable there would have been no fatality or serious injuries had the blower been in operation. The draft it creates would have forced the escaping steam up the smoke stack instead of allowing it to envelop the fire-room crew, as it did.

The men of the Hopkins complain bitterly of conditions in the fire-room. They say that they risk their lives whenever they go below. They declare that there is something wrong with the boiler construction on the torpedo boat destroyers. They say that yesterday's accident is identical with that on the Hull last June, when seven men were scalded, one fatally, as the vessel was passing through the Golden Gate.

In the last nine months, the men say, ten tubes have blown out in the boiler room of the Hopkins, on three occasions the circumstances being similar to those of yesterday, but fortunately the blowers were running at the time of the blowing out, and casualties were avoided.

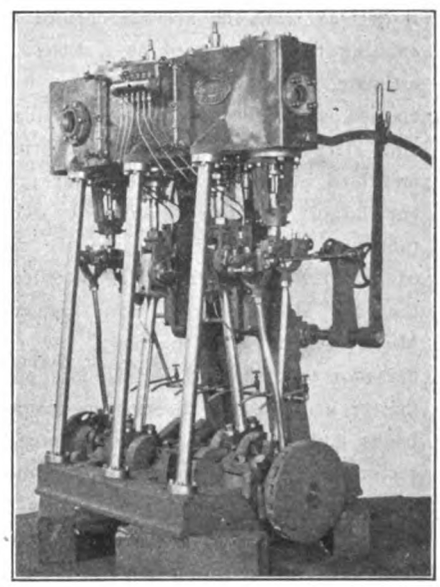
It is a matter of common knowledge that the conditions aboard the torpedo boats and destroyers of the United States Navy are far short of satisfactory. They are, in fact, such as to justify absolute lack of confidence and are destructive of morale.

In spite of denials by bureau officials, advices are at hand from trustworthy sources, giving details of the condition of machinery and equipment of a number of the ships of the navy, which not only go far towards confirming the press dispatches regarding the crippled state in which the West Virginia and Maryland reached San Francisco, but indicate that most strenuous efforts are being made to hush matters up. Admiral Barry, although denying these reports, admits that the two ships were towed a large part of the distance from Honolulu "because he wanted some data on towing." The reason many satisfy members of congress and laymen; to others it is as though the admission were shouted from the housetops.

The Hopkins in common with all torpedo craft is fitted with forced draft on the closed stokehold system, which explains the press statement quoted to the effect that had the blowers been running the escaping steam would have been driven up the stack instead of filling the stokehold. This is, however, not borne out by facts, as numerous instances of bursting tubes have occurred with the blowers in operation and which were attended with casualties. The men of the Hopkins are absolutely correct; there *is* something wrong, but the trouble need not be looked for aboard the ships themselves. The trail leads into comfortable offices, cafes, clubs and inner circles in Washington, and when business methods and merit govern the administration of the navy department, the boilers and other equipment of the ships of the navy will render the service that is to be expected of them.

ENGINE OF STEAMER COLUMBIA.

The engine illustrated herewith has recently been built by the Northwestern Iron Works, Seattle, for the Puget sound steamer Columbia. As may be seen, the engine is of the 2-crank compound type; the cylinders are 10 and 22 in. diameter, with a stroke of 15 in. The engine is designed for a working pressure of 165 lb. and at 200 revolutions, will develop approximately 300 I. H. P. at 75 per cent cut-off. The high pressure cylinder is fitted with a piston valve with adjustable rings, and the low pressure with a flat balanced slide. The valve travels are 3½ in. The engine bed plate is 6 ft. in length by 4 ft. 2 in. wide. The crank shaft and crank pins are 4¾ in. in diameter, the length of the latter being 5 in. The crosshead pins are 3½ in. diameter and 3¾ in. long. The piston rods are 2 3/16 in. diameter. The connecting rods are 6 cranks in length. The cranks are set at 135 degrees, so that the reciprocating weights largely balance. The difference in weights between the low pressure and high pressure pistons, together with the angular effect due to the relation of the cranks, is compensated by balance weights in the pinch wheel.



ENGINES OF STEAMER COLUMBIA, BUILT BY NORTHWESTERN IRON WORKS, SATTLE.

LAUNCH OF THE "EDINBURGH CASTLE."

Harland & Wolff, Belfast, Ireland, recently launched the Edinburgh Castle for the Union-Castle Line for South African service.

The Edinburgh Castle is 585 ft. 9 in. over all, 64 ft. 8 in. beam, 42 ft. 6 in. deep, with a gross tonnage of about 13,460 tons, and 12,500 I. H. P. The vessel is fitted with twin-screws. She is constructed of steel throughout to the requirements of Lloyd's Register, with special regard to stability and safety. The cellular double bottom extends the full length of the ship and the holds are subdivided into separate compartments by watertight bulkheads, a double collision bulkhead being fitted forward.

In the arrangements for the comfort of passengers every modern improvement has been taken advantage of both in the general design and in the vessel's fittings and appointments. The cabin accommodation is as follows:

First class, about 320;
Second class, about 220;
Third class, about 250.

The first class staterooms will be on the upper and main decks, the larger number being arranged for two passengers, while on the promenade deck there will be a group of large handsome staterooms, which can be divided into suites of two, three or four rooms. On the main deck the staterooms will be arranged with sliding Venetians over the side ports, so that the most perfect ventilation is assured, and the light in the room may be regulated at will.

The second class public rooms and accommodation have also received special consideration, containing saloon, library, smokeroom and staterooms, all being large and comfortable and artistically decorated.

The third class accommodation is likewise of a very superior type. The dining saloon has a separate pantry and bar, and there is a large comfortable smoking room. Moreover, the spacious entrance to the third class accommodation on the upper deck has seats round it and is supplied with a piano, making a very pleasant sheltered lounge. There is also an extensive library for third class passengers.

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AFRAID TO INVESTIGATE.

THE MARINE REVIEW has consistently opposed the program of naval expenditures and has protested over and over against the waste of funds for which the craze for naval supremacy and the inefficiency of our naval system is responsible. In our December number, referring to the proposed 48-battleship program and taking the rate of production, growth and cost of the existing fleet as an index, we said:

"Sixteen years then would be required to produce what our experts consider to be our prime necessities. If the rate of increase in tonnage which has obtained in our own and foreign navies during 15 years, should be maintained, the final ship in 1926 would approximate 50,000 tons, and the cost, even though the price per ton showed no increase, would approximate $25,000,000. Now these figures may be ridiculed by naval experts just as they have ridiculed others before only to prove their accuracy later, and it is sincerely to be hoped that they are excessive, but in view of the present ascendency and popularity of the navy, an attempt to carry out this program is not at all unlikely. The average cost of the 48 ships then, would be about $18,000,000, or $864,000,000 for the two fleets which we must have, and this entirely independent of all other construction such as cruisers, torpedo boats, submarines, colliers, etc., and exclusive of the maintenance and operation of the department which already amounts to over $100,000,000 per year."

It will be observed that in the foregoing the figure of $500 per ton, which is derived from the average cost of the existing fleet, was used as a basis for estimate. Three months only have elapsed since these figures were made and already it is proposed to bridge one-third of the gap between our present largest authorized ship of 24,000 tons and the estimated prospective ship of 50,000 tons in 1926. His Excellency the Rt. Hon. George Von Lengerke Meyer, secretary of the navy, late embassador to Italy and Russia, late postmaster general, late director in national banks and trust companies, and late director in some of the largest and most successful manufacturing companies of New England, etc., etc., has suggested that congress authorize the building of a 32,000-ton battleship to cost $20,000,000. It will be observed at once that our estimate is badly punctured and that it sadly needs revision in as much as the rate of $500 per ton is shown to be far too low, the latest figures working out at $625 per ton.

To be sure, there is scarcely a remote possibility that congress will give the Hon. George Von Lengerke Meyer anything of the kind just now, but the request proves that which we have so frequently said and more. It proves, if any proof were needed, that the demand first made by THE MARINE REVIEW and reiterated by the able author of "Naval Reorganization" in our February number, for an investigation of the navy department from the Hon. George Von Lengerke Meyer downward by a civilian and non-congressional commission of business men is urgent. But it will not be done. THE DEPARTMENT DARE NOT FACE IT AND CONGRESS DARE NOT ORDER IT. The department knows, and congress is afraid of, what would be uncovered. Secretary Newberry started something and the whole naval coterie immediately went into convulsions. They were scared, and at the earliest possible moment the Hon. George Von Lengerke Meyer brought the proceedings to a full stop and took steps to cover the whole mess over and clamp on the lid. That is all that the Meyer reorganization is. The reorganization is merely the words put into the secretary's mouth by the line organization. Let no one suppose that it is the product of the secretary's own brain. It is nothing of the kind.

In commercial life, when a concern needs a head for its working organization, a selection is made from men possessing a knowledge of the business. When the United States wants a head for the department of all others needing a special training, it selects a man who knows nothing about it. President Roosevelt had in Secretary Newberry the only incumbent of the office who by temperament, business training, taste and experience was fitted for the position. The result was inevitable and was discounted a year ago. It was necessary that a secretary should be had who did not know so much and who would be guided by the line officers, those gallant swivel chair sailors who are busy trying to fix shore berths for themselves, and in the Hon. George Von Lengerke Meyer the proper plastic material was found.

THE MARINE REVIEW again urges an investigation. Let us pry the lid off and get things sorted out before the miserable mass blows itself to pieces, possibly at a time when the eyes of the country are turned hopefully towards its tin navy, hoping it may justify its existence. IS CONGRESS AFRAID? We know THE NAVY DEPARTMENT IS. There are signs that members of congress are becoming alarmed over national expenditures. If they want to make a start at reduction they will strike pay dirt in the navy department the instant that

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inquiries are set on foot. It is a matter of common knowledge amongst those familiar with shipping and shipbuilding and even within the department itself, and we have knowledge of dozens of credible witnesses whose testimony cannot be gainsaid, both within and without the department, who would gladly avail themselves of the opportunity to tell what they know.

INVESTIGATING THE GOVERNMENT'S BUSINESS METHODS.

A short examination made by competent persons in the two bureaus of one of the great departments of the government discloses the fact that the adoption of business methods would save 20 per cent of the expenditures and at the same time increase the efficiency of the service. There is no intelligent observer in congress or out of it who does not know that the executive departments of this government are carried on either under obsolete business methods or without business methods at all. There is no man who has given the subject any attention whatever who does not know or believe that at least 10 per cent of the $1,000,000,000, which we are appropriating annually, can be saved by the adoption of business methods.

* * * *

We have not only obsolete methods in all of the departments, but we have in them duplication of bureau after bureau.

* * * *

If I were a business man and could be permitted to do it, I would undertake to run this government for $300,000,000 less a year than it is now run for. I tell you, gentlemen, this investigation ought to be made by somebody. I will say that this movement has the hearty and earnest support and co-operation of the president of the United States, who appreciates, as we do, the importance of having these methods examined and corrected and reformed, if possible.

In these words, Senator Aldrich brought to the attention of the senate the necessity for the appointment of a commission to investigate the business methods of the government. It was a pretty hot shot and it certainly stirred things up amazingly. All that was said is doubtless true and more besides. Abundant evidence has been adduced to prove the shameless waste of money. Take the navy department alone. The articles on the Naval Waste recently concluded in our columns showed how foolishly and extravagantly money was squandered; and what is true of the navy department is true of all other branches of the government.

Senator Aldrich was well within the mark when he stated that $100,000,000 could readily be saved by the adoption of business methods and that a capable business man could operate the government for $300,000,000 less than it is now costing. The bill as originally drawn provided for the appointment of a commission of nine members, three from the senate, three from the house and three from civil life, the latter to be appointed by the president. As there was opposition to this combination of the legislative and executive ends, Senator Aldrich proposed to modify the bill to provide for a commission of ten members, five from the senate and five from the house.

It is known that this investigation is in line with the president's wishes as he has already indicated to his cabinet that retrenchment is in order and has asked for revised and reduced estimates.

We presume that there are ten men in congress who are competent to intelligently inquire into the business methods pursued by the various departments and to recommend effective remedies. We could put our hands, however, upon ten men in civil life who could do the job and it would be cheap at $300,000, which is the sum that the proposed investigation is expected to cost.

POWER BOAT RACE THROUGH NIAGARA RIVER.

THE MARINE REVIEW in its November issue in an article dealing with the Maid of the Mist's trip through the whirlpool rapids used the following words, which are now of prophetic significauce:

"It is safe to say that the simple announcement that on a given date a steamer would leave the boat landing at the foot of Niagara Falls for Lewiston would bring more people to Niagara than New York held during the recent Hudson-Fulton celebration."

Apparently this prophecy is likely to be realized. Evidently the article contained the germ of an idea, for since then *Power Boating* has offered a prize of $1,000 to the power boat that makes the best time from the boat landing below the falls to Lewiston. The interest exhibited has been acute. Scores of contestants have entered and a number of power boat manufacturers have signified their intention of entering their boats.

The Niagara river from the railroad bridges below the falls to Lewiston is undoubtedly the wildest race of waters in the world. It is likewise one of the most sublime spectacles of nature, exceeding in the embodiment of ruthless power and the majesty of unbridled energy even the falls themselves; but there is no doubt that the trip is both feasible and safe. The man that enters the race should first study his course. He will have but a very few moments of activity, but his plan of action must be well defined in advance. He need strike no rocks; he will meet with no obstructions whatever, except such as are generated by the water's own troubles in finding its exit through this fearfully compressed channel-cross currents, eddies and back swells caused by the frenzied effort of the water to liberate itself.

The Maid of the Mist is the only vessel that has ever made this trip under power. She lost her smoke stack at the first shock, but she reached Lewiston safely. Boats have gone as far as the whirlpool without power, to circle aimlessly about, unable to release themselves from its grasp. A power boat, sensibly designed and moderately powerful, ought to negotiate the rapids with reasonable ease. The crucial moment will come abreast of the whirlpool, but if she keeps the American shore close aboard at the turn she should have no difficulty and will be borne rapidly on her journey to Lewiston, for the main spill of the water is to the right. Below the whirlpool the channel, if turbulent, is comparatively straight and she should ride it joyously.

It is understood that the race will be held during the coming summer and that leading interests along the Niagara river, especially at Niagara Falls, are becoming actively interested in the test. The power boat clubs and associations the country over, and particularly at Buffalo, have taken hold of the project with enthusiasm, and as there are believed to be something like 300,000 power boats in the United States alone, a large attendance is certain.

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TRADE WITH PANAMA AND THE PHILIPPINES.

On January 27 Hon. E. A. Hayes introduced in the house of representatives a joint resolution to the following effect:

"That hereafter the transportation by sea of (a) materials, stores and equipment for the use of the army or navy of the United States; (b) of the forces of the United States; (c) materials, stores and equipment from the United States for use in the construction of the Panama canal; and (d) of all material and equipment for use on construction or maintenance of fortifications, harbors, navy yards, naval stations, or other works for account of the United States, shall be restricted to vessels of the United States and no others; and such transportation, when time will permit, shall be furnished by contract, after proper advertisement, by the lowest bidder complying with the requirements of the United States."

The wording of that resolution is compact, concise and unequivocal. There is no getting away from its intent; there is no loop-hole in it at all. Under its provisions no more navy coal could be carried to the Pacific coast in foreign ships; no supplies intended for use in the construction of the Panama canal could be carried in foreign ships; no government supplies intended for the army and navy could be carried to Porto Rico or the Philippines in foreign ships. It is a resolution that deserves to pass precisely as it stands. The government has no right to expect its citizens to pay more for transportation than it is willing to pay itself.

Senator Frye has introduced in the senate a resolution of a somewhat similar nature, but so worded as to present numerous loop-holes. His resolution reads:

"That Section 1 of the act approved Feb. 17, 1898, entitled 'An Act to Amend the Laws Relating to Navigation' hereafter shall extend to merchandise transported for the government of the United States and property owned by the government of the United States.

"Sec. 2. "That in any contract hereafter made transportation by sea of material and equipment from the United States for use in the construction of the Panama canal shall be restricted to vessels owned by the United States or by the Panama Railroad Co., or to vessels of the United States chartered by the United States or by the Panama Railroad Co., or to vessels of the United States tended by the lowest responsible bidder, if any be tendered, unless the President shall in any case deem such bids or tenders to be extortionate or unreasonable."

It will be seen that this resolution eliminates the possibility of further shipments of navy coal to the Pacific in foreign ships, but it leaves the matter of shipments of government supplies of all descriptions to the Philippines and Porto Rico open. Now what sound reason is there why government supplies should not be carried to the Philippines and Porto Rico in American bottoms? The extension of the coastwise laws to the Philippines was suspended at the government's request on the ground that there were not sufficient ships offering; but surely there are sufficient ships to provide for the government's own requirements and if this trade is reserved for them, does it not clearly make a beginning for commercial relations in our own ships with our dependencies?

Section 2 should be amended to end with the words "responsible bidder" or else add to it "as compared with charges to private parties for similar service." The government can have no complaint whatever if it is asked to pay the same sum that its own citizens are asked to pay. In equity it should not expect to pay less.

The sensible thing to do would be to pass the Hayes resolution as originally drawn and then there can be no doubt as to what was intended.

BRITAIN'S GREATEST DOCK YARD.

Portsmouth, which was visited by a large party of members of Parliament is England's greatest naval port, and with its arsenal and dockyards, forms the largest royal naval establishment. The seaport comprises the town and harbor of Portsmouth, together with the adjoining towns of Portsea, Landport, Southsea and Gosport, the last being on the other side of the harbor. A battleship will find sufficient depth of water to enter at any state of the tide. The entrance is narrow, but the harbor expands into a basin four miles long, with good anchorage and depth in almost every part. The Victory—Nelson's flagship at Trafalgar—lies at anchor side by side with the latest floating fortresses of steel, and within hail of such representatives of modern naval developments as the torpedo school ship Vernon and the depot ship for submarines.

Portsmouth has by no means unimportant commercial shipping interests for which ample provision is made by the civil port authorities. Its associations with memorable events and famous deeds in English history during the last eight centuries form an unsurpassed record. From its harbor, Nelson and other great commanders sailed to win many a famous victory. Nor should it be forgotten that here Charles Dickens was born, his father having been an official in the Naval Department.

Royal Naval Dockyard was established in 1509, though the first dock was not constructed until 1698. It now comprises about 300 acres of basin, docks, slips, factories, workshops and storehouses, while the extension works completed within the last few years and occupying ground reclaimed from the harbor contain three large basins respectively for repairing, rigging and fitting. The area of these docks is 53 acres, and the depth suffices for any ship now in existence. There are also a final basin of ten acres, 15 first-class docks, and several slips, in one of which the largest vessels can be constructed. Two other docks were completed in 1897 at a cost of £370,000. These have each a length of 580 feet, with a width of 120 feet at the coping level and 75 feet on the floor.

The Naval Barracks near at hand will accommodate 4,000 men. Admiralty House is the residence of the admiral-commanding-in-chief, while the Royal Naval College, established in 1750, is now occupied by the torpedo and gunnery students drafted from the navy. The gun wharf is the main depot for ordnance and stores both for land and for sea service. Whale Island in the harbor is a considerable plateau formed by depositing materials from dock excavations. It is the site of the largest gunnery school in the world.

Fortifications, strong and elaborate, proclaim the vital importance of Portsmouth to England's security. Numerous detached forts form a complete circle round the town at an average distance of four miles from the center

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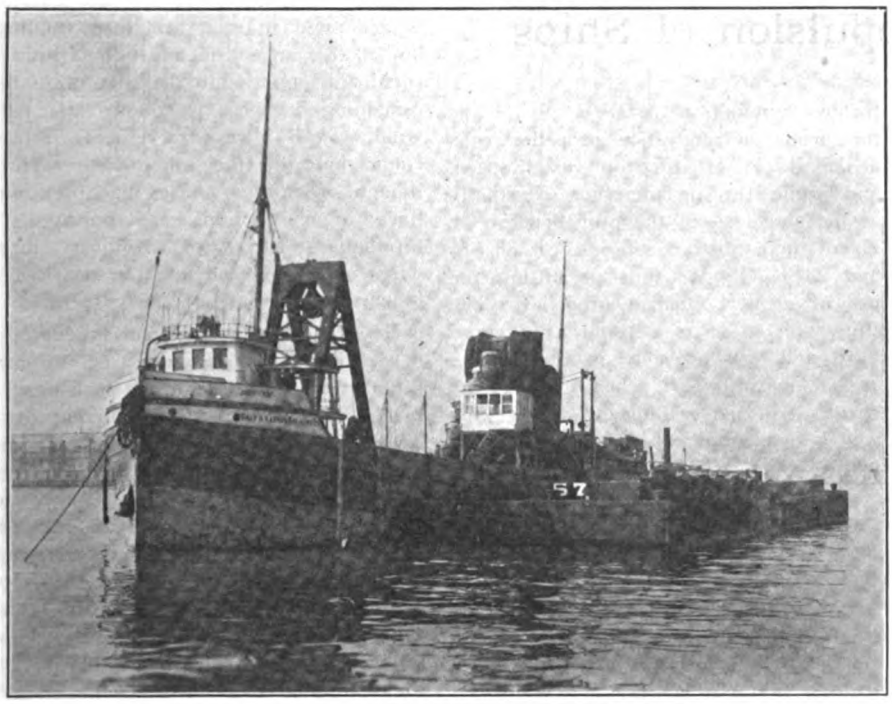
of the dockyard. Three of these rise from the sea at Spithead, resting upon foundations built up from the bottom. These are armor plated. The entrance to the harbor is guarded by the batteries on the Portsmouth shore and several detached forts, while other batteries, some masked, and others defiantly showing their teeth occupy the high ground above the town. The Royal Powder Magazine at Tipnor contains the supply of gunpowder for His Majesty's forces in the Southern district. The principal magazine, however, is at Marchwood, near Southampton, ten or twelve miles away. Eastney Barracks, three miles from Portsmouth, are the headquarters of the Royal Marine Artillery, and will hold 1,200 men. They are defended by strong earthworks, connected with a long stone coping.

Elevator Dredge for Coast Harbor Work

WE have received from the Atlantic Equipment Co., New York City, some interesting particulars of a large elevator dredge, which they have equipped for work in Boston harbor. The illustrations will be of particular interest to shipping men on the great lakes where the steamer Denver was well known. The use of elevator dredges in harbor work in the United States has been of a very restricted nature, although the Canadian government has used them more or less extensively on the St. Lawrence river and canal improvements. They have also been used in gold dredging work in the western states and in Europe their use for harbor work is quite extensive. The Atlantic Equipment Co. says:

The work in the entrance to Boston harbor covers a large area and excavation is required to a depth of 35 ft. below the low water level. This means that at high tide the dredging must be done at depth of about 50 ft. The Daly & Hannon Dredging Co., of Ogdensburg, N. Y., which has the contract for this work, had been, for many years, executing all their work with dipper dredges, but in this case, on account of the depth and the exposure to rough weather, it was decided that a seaworthy elevator dredge of large capacity would be more apt to give satisfactory results.



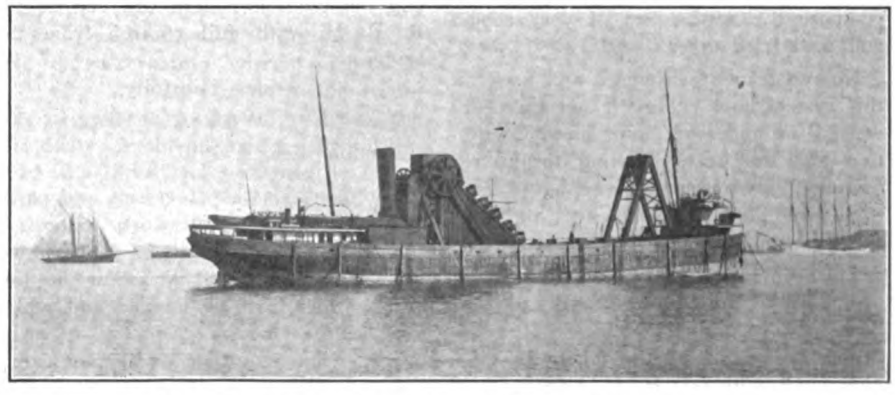
PORT SIDE OF DENVER SHOWING CONTROL HOUSE AND DISCHARGE CHUTE.

To meet these requirements, the dredging machinery was installed in the steamer Denver, a heavily built wooden cargo steamer originally in service on the Great Lakes. The contractors were fortunate in obtaining a vessel with oak frames and planking in such perfectly sound condition and of a quality not generally available nowadays for shipbuilding. The Denver is self-propelling, with engines of 700 H. P., and is able to cross the ocean if necessary. The work of reconstructing the hull and installing the dredging machinery was done by the Daly & Hannon Dredging Co. in its own yards at Ogdensburg, N. Y.

The dredging machinery was built by the Atlantic Equipment Co., from the designs of A. W. Robinson, of Montreal. The form of the buckets is shown in the accompanying photo, which gives also some idea of their size. All parts subjected to heavy wear are of manganese steel. The capacity of each bucket is 1¼ cu. yds. and the bucket chain is driven ordinarily at a rate of 14 buckets per minute, so that the dredging capacity with full buckets would be 1,100 cu. yds. per hour. This has been exceeded by more than 30 per cent for short periods in actual use. For driving the bucket chain, a double tandem compound steeple engine is provided, with cylinders 12 in. and 16 in. by 18-in. stroke. This is, of course, entirely distinct from the propelling engines.

The ladder frame is of steel and is of sufficient length to work at a depth of 51 ft. The steel gantry for raising and lowering the digging end of the ladder can be seen just behind the pilot house.

The dredged material is discharged through a hopper and chute into scows of 1,800 cu. yds. capacity alongside. A sea-going tug is required in attendance to tow the scows to the dumping place and to advance from time to time the anchors which hold the mooring lines of the dredge. There are two bow and two stern lines from the dredge attached to heavy anchors placed at suitable distances, the position of each of which is marked by a buoy. A continuous feed over the bottom is obtained by means of steam winches handling the mooring lines, and by a special arrangement these lines are held at some depth under the water so as not to interfere with the navigation of the tugs



ELEVATOR DREDGE DENVER AT WORK IN BOSTON HARBOR.

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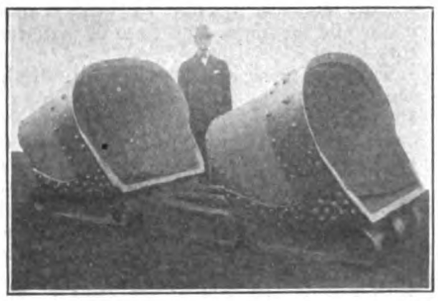
and scows. In this way a width of channel up to 700 ft. can be made at one time. All of the operations of the



A SECTION OF BUCKET CHAIN OF DENVER.

dredge, including that of the winches, are under the control of one man through levers in the elevated control house, shown amidships on the delivery side.

After a year's service, the buckets with their pins and bushings are reported in good condition and the general loss of time and cost of repairs is said to compare favorably with that of a dipper dredge on the same class of work. The material encountered at different parts of the channel included hardpan, clay, stone and gravel. The ordinary yardage for a single day's work was about 8,000, and under favorable conditions as much as 10,800 cu. yds. was dredged in one day. In a run of 55 minutes' duration, 1,470 cu. yds. were dredged.

The Denver was built in Milwaukee in 1890, and is 224 ft. keel, 37 ft. beam and 21½ ft. molded depth. She is equipped with a compound engine, 23 and 42 in. diameter by 42-in. stroke, with one marine type fire-box boiler, 12 ft. 6 in. diameter, 15 ft. long.

The Electric Propulsion of Ships

WE are pleased to be able to present herewith a letter from William P. Durtnall, whose system of electric propulsion has attracted much attention in Europe. It is of interest to note that Mr. Durtnall has been awarded the Denny gold medal for his system of ship propulsion, which is attracting a great deal of attention in marine engineering circles.

Editor MARINE REVIEW:

I have read with considerable interest the very able report in your issue of December last, and am pleased to see that American engineers, and above all shipbuilders and owners, are looking into the great possibilities of electrically driven boats.

Although I suppose most of your readers have heard of my system, I dare say that there are some who have not, and I have pleasure in enclosing to you a description of my system in one form of layout, which any electrical engineer, who has experience in polyphase alternating current work and design, will agree is most efficient and light in weight, and the machines that compose the system are of very robust and well tried types.

No wasteful resistances are used in this system, and energy is not therefore wasted in reversing and speed regulation and the heavy starting torque required in starting and reversing is most efficiently got by means of the low frequency current.

The control can be from the flying bridge, and the engineer will have a nice easy job on the vessel that I am fitting up at one of the north of England ports with 600 H. P. with a steam turbine running at 3,000 R. P. M. as the prime mover. The propeller runs at 85 R. P. M. for top vessel speed, and while the turbine runs constantly at the above speed the propeller can be given three distinct speeds of 85, 56 and 28 R. P. M., thus permitting the use of a most efficient propeller. The ship referred to is a tramp type cargo boat, and will probably in time arrive at an American port, when I expect my clients will be willing to allow any well known American naval architect or marine engineer to inspect her.

There will be a saving in this instance of not less than 20 per cent in coal as compared with the reciprocating engines that are being displaced, and I hope to let you have the trial results at a later date.

I have another boat in hand, in which suction gas will be used to supply an internal combustion engine as prime-mover; this boat is for the British coal trade.

A private yacht is also to be equipped this year with two 50-H. P. DeDion petrol engines running at 1,250 R. P. M., and the twin propellers will run at 150 R. P. M. with full control from the bridge.

Yours faithfully,

WILLIAM P. DURTNALL.

London, Feb. 4, 1910.

For many classes of vessels and particularly for commercial work, there is a rapidly-growing demand for an installation that will give its power at low speed, which will be flexible and which can be reversed as easily as a steam engine. The requirements are being met every day more closely by developments of engines themselves, but to a certain extent the advantage of lightness and compactness of higher-speed motors are being lost, and it is in an endeavor to combine the good qualities of the high-speed engine with the high propeller efficiency of the low-speed type that electric transmission has been introduced.

Before explaining the details of the Durtnall system, of which connection diagrams are shown in Figs. 1, 2 and 3, it will be as well to say a word on three-phase generators and motors which, though really quite simple, seem rather formidable to those not much acquainted with electrical engineering. Briefly, a three-phase generator is an alternating current dynamo with three sets of windings on its armature. The armature is stationary, and the field magnet is rotated and is supplied with direct current from a small separate dynamo or exciter. A separate current is generated in each armature winding, but as the current in any two is always equal and opposite to the current in the remaining winding, it follows that one winding will always serve as a return connection for the other two. Thus, though in a two-phase machine four lines of connections are required, a three-phase alternator requires three wires only, and each must be considered to carry one phase of the current.

Now, if such a three-phase generator is driven at a constant speed by any satisfactory prime mover such as a turbine, gas engine, etc., a current of a certain periodicity dependent upon the number of poles in the field magnet will be produced. We will assume, for our purposes, that we have a four-pole field magnet, and that the engine speed is 900 R. P. M. We will now turn to the motor. What is known as a squirrel-cage motor is used. It is perhaps the simplest form of electric motor that it is possible to make. The armature or rotor consists simply of a number of bars of copper insulated from each other and short circuited; the stator or surrounding iron frame may be regarded as a field magnet, which is supplied with alternating current. There is no electrical connection whatever between the stator and the rotor, and it must suffice to say that what is known as a rotating magnetic field or flux is produced when a three-phase current is supplied to the stator. This exercises a pull on the rotor, which runs at exactly the same speed as the flux (neglecting a very small slip, which need not be considered). The peculiar property of a squirrel-cage motor is that its speed is entirely independent of the load; it will take very much higher loads than it is designed for, and even if excessively overloaded its speed never

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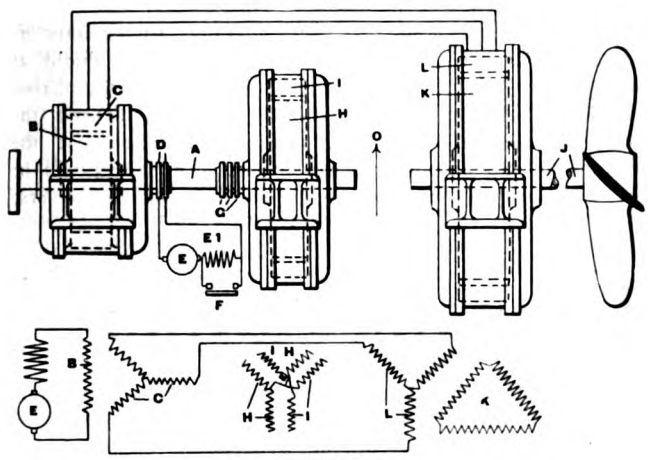

FIG. 1.

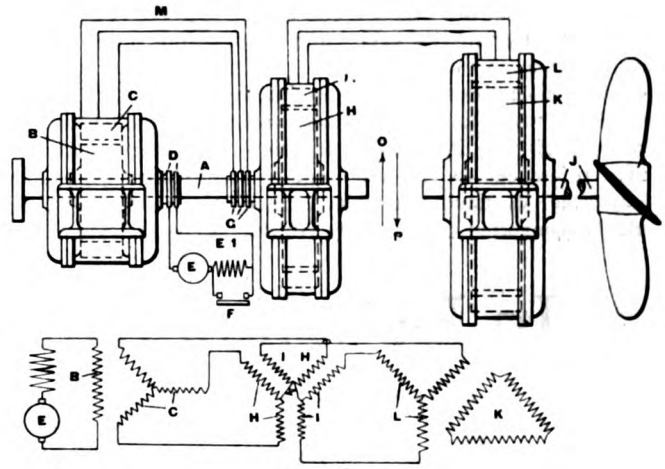

FIG. 2.

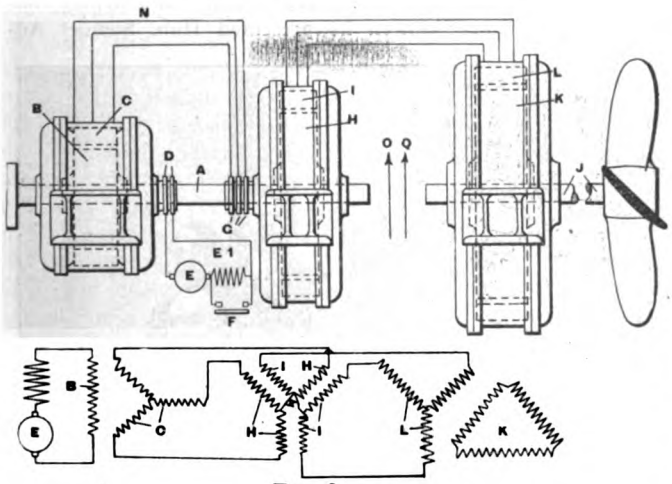

FIG. 3.

varies—after a certain point it will simply stop altogether. We will now assume that there are 40 poles in our stator; we have already mentioned that there are four poles in our three-phase generator, and if current from the latter be supplied to the motor, the result will be that it will rotate at one-tenth of the alternator speed, *i. e.*, at 90 R. P. M. Fig. 1 shows the arrangement. C is the stationary armature of a three-phase generator; B is the four-pole rotating magnet supplied with current by the small exciting dynamo (E) through the slip rings (D). The three-phase connections of the motor stator (L) are shown. K is the squirrel-cage rotor, which, as already explained, will drive the propeller at 90 R. P. M. when the generator is driven at 900. In the lower part of the diagram are shown the electric connections, which, however, will convey more to an electrical engineer than to the average reader. It will be noticed that on the shaft of B there is another machine (H). This may be regarded as a special form of induction coil in which the primary is rotating, the secondary remaining stationary. It is really what is known as a transformer generator. The rotating "primary" has 12 poles, the three-phase winding of the secondary being taken to the slip rings (G). We will now show how this machine can be used to give a higher speed to the propeller. Fig. 2 shows the change that must be made in the connections; the generator armature is now connected to the slip rings of the transformer-generator, and the secondary of the latter is connected to the stator of the squirrel-cage motor. Now the "primary" (H) of the transformer generator is being driven at the same speed as the four-pole generator, and, as it has 12 poles, it follows that the current generated in the secondary would have three times the periodicity of the generator current were it not for connections just made to the slip rings. The effect of supplying alternating current to H is, however, to produce a rotating magnetic field turning in the reverse direction to that in which the transformer generator is driven, so that in effect for every three turns ahead there is one turn backwards. The result is that the alternating current generated in I (the stationary part of the transformer generator) has only twice the periodicity of the alternator current instead of three times—hence, if I be connected, as shown, to the stator of the motor, the propeller will be driven at twice the speed at which it turned in Fig. 1, *i. e.*, at 180 R. P. M.

Now we come to Fig. 3, which to all outward appearance is the same as Fig. 2. If, however, we interchange two leads between the alternator and the transformer generator, the effect is to reverse the direction of rotation of the magnetic flux. We now have the flux turning in the same direction as the primary of the transformer dynamo, so that, instead of subtracting the speed of rotation of the flux, it must be added, which gives us a resultant periodicity of $3+1=4$ times the alternator periodicity. If, therefore, the secondary (I) be connected as before to the motor, four times the original speed will be obtained, *i. e.*, 360 R. P. M.

Thus, simply by altering electrical connections which can be arranged very simply on a controller, though very difficult to describe, it is possible to obtain three different speeds ahead with the engine running at constant speed, and all of them, moreover, speeds admitting of the very highest propeller efficiency. There is the additional advantage that the squirrel-cage motor being of small size, and so simple that nothing can go wrong with it, can be tucked away in the stern and put as low down in the boat as can be desired, giving the advantage of a horizontal propeller shaft. The oil engine and the three-phase alternator, on the other hand, together with the transformer generator, can be put in whatever part of the vessel may be most convenient, either right forward or, if convenient, on deck.

A very small acquaintance with electricity will be enough to show any reader that these changes in connection would cause a great deal of sparking were they carried out in the way described, but a very simple arrangement entirely gets over the difficulty, the whole system being automatically brought to a no-voltage state before any change in the connections is made. This is done by means of the exciter (E) of the alternator; its field magnet winding (E1) is so arranged that it can be short-circuited by the connection (F), which has the effect of reducing the field-magnet current to zero, and so producing a no-voltage state throughout

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the system; this short-circuiting is arranged for automatically every time the control gear is operated.

It is possible, by the way, to obtain a speed intermediate between "two" and "three" of 270 R. P. M., but for simplicity reference to it was omitted. Briefly, the continuous-current exciter would be connected to two only of the slip rings (G) of the transformer generator instead of the slip rings of the three-phase alternator. The flux in the member (H) then becomes a fixed one, and the transformer generator then simply runs as an ordinary 12-pole alternator generating current at three times the periodicity of our original four-pole alternator.

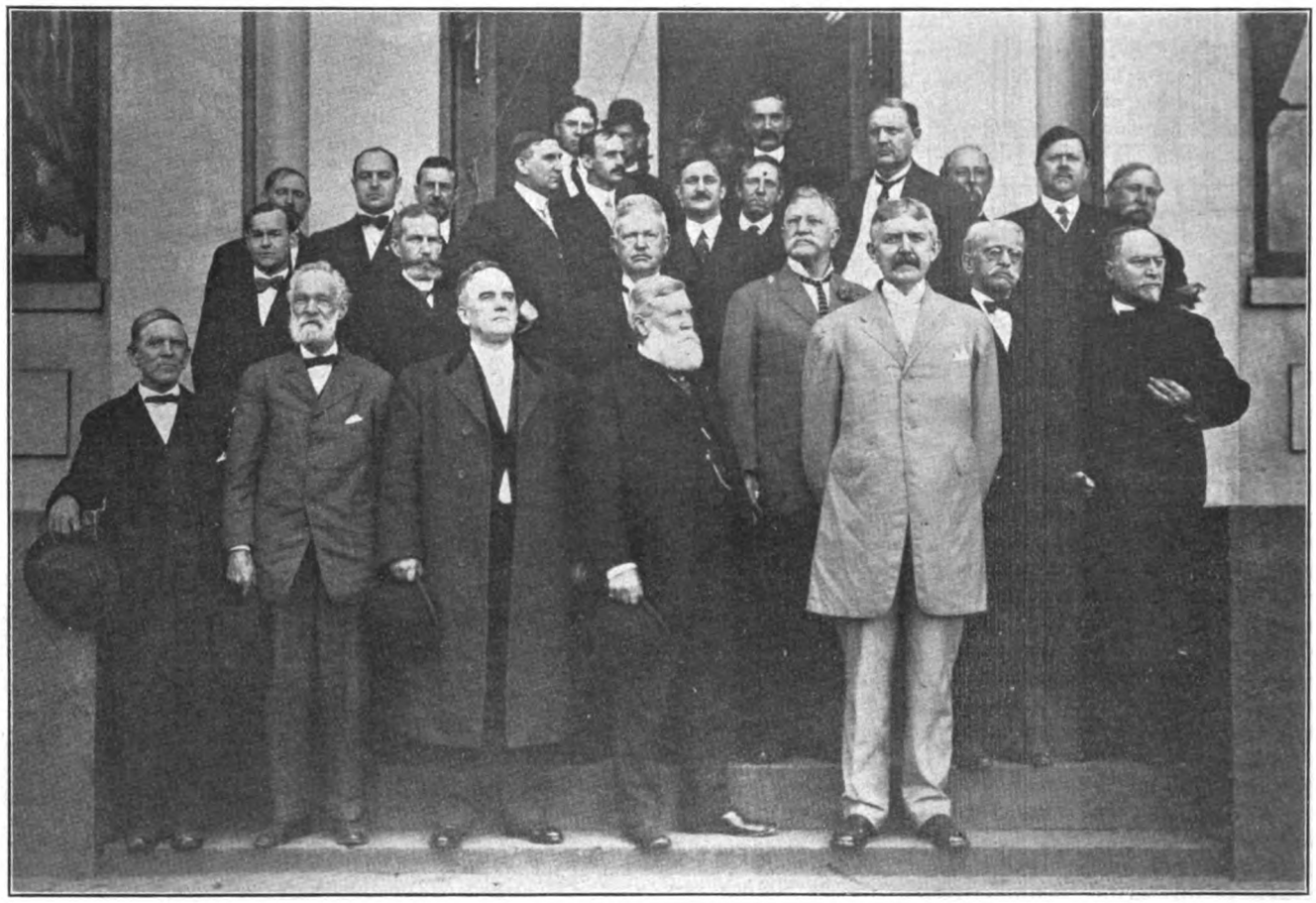
As has already been explained, a reversal of the direction of rotation of the magnetic flux can be produced at any time by reversing two of the phases, and this can be done in exactly the same way to the connections of the squirrel-cage motor. The effect will be that on any of the four speeds a reverse drive can be obtained.

In Behalf of Our Merchant Marine

WHAT has been termed a revolution in the sentiment of the South towards the restoration of the American flag to the high seas, has taken place in the Gulf states as a result of the convention held at the Progressive Union hall here, Feb. 14 and 15. The convention consisted of delegates from the commercial bodies of the leading ports of the South, there being present business men from almost every port from Corpus Christi, Texas, to Jacksonville, Fla. The principal sessions took place in the afternoons of the two days, the mornings being devoted to committee work and preparation for the afternoon assemblies. Several speakers of international note were present and delivered stirring addresses.

Chief among these speakers was Col. John Temple Graves, of New York, late of Atlanta, who is the editor-in-chief of the *New York American*. He showed how vitally important it was to secure an auxiliary to our navy and said that he believed that there was not an American who did not believe that our navy should be strongly re-inforced from the merchant marine. He believed the best thing to do was to pass the Humphrey bill as an emergency measure so that the crying need for a merchant marine might be met with the least delay.

The first speech of the convention was delivered by President Philip Werlein, of the Progressive Union, at the morning session on Monday. It was of an introductory nature and at its conclusion he presented Hon. Samuel Adams Trufant, president of the Merchant Marine League of Louisiana, as the temporary chairman of the meeting. Mr. Werlein in his remarks dwelt upon the necessity of party reform in the South. He said that there was no question of such vital importance before the country as the auxiliary navy. The South had erred persistently, he declared, in making this question a partisan matter. Mr. Werlein predicted that trade relations



NEW ORLEANS CONVENTION IN BEHALF OF AMERICAN SHIPPING.

Bottom row, reading from right to left—Congressman Andrew J. Barchfeld, Capt. Thomas Woodward, of New Orleans, Hon. James L. Elwell.

Second row—Hon. James T. McCleary, Hon. P. Wight, of Louisiana, Hon. Louis P. Bryant, Hon. Peter S. Lawton, vice president of the Merchant Marine League of Louisiana; Hon. C. H. Ellis, president New Orleans Board of Trade; Hon. S. A. Trufant, president Merchant Marine League of Louisiana.

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with Central and South America would increase rapidly with the restoration of the American merchant marine. He said that a change of the political complexion of the Gulf states of the South would have a most salutary influence upon their growth and development. This was regarded as the key-note of his address, and coming from a Democrat of unquestioned principles and a state office holder and an appointee of a Democratic governor, it was considered the strongest possible argument for non-partisanship in the treatment of the great issue.

As the first speaker of the first afternoon session, President Trufant introduced Hon. James T. McCleary, formerly a member of Congress from Minnesota and later second assistant postmaster general of the United States in charge of the foreign mailing department of our government. Mr. McCleary made a forceful address, explaining in detail the Humphrey bill. His discourse was of the utmost value, being delivered by a man of valuable experience in the handling of ocean mails. The distinguished Minnesotan told how his interest in the question had first been aroused, and said that, while he had always been in favor of the creation of an American merchant marine from patriotic motives, he was more than ever convinced of the justice of his faith when he found that American mails had to be carried in foreign bottoms because there were no American ships in which to carry them.

Congressman Andrew J. Barchfeld, of Pittsburg, made a stirring and eloquent address upon the necessity of a merchant marine from a patriotic and commercial standpoint. He devoted considerable time to the demonstration of the effect of the disappearance of American ships from the Pacific ocean on our trade with Honolulu, Australia and New Zealand by calling attention to the retirement of the three handsome ships of the Oceanic line. These, the speaker said, while in the trade and carrying the American mails to the ports of the countries named built up our commerce from about $12,000,000 per annum to more than $28,000,000. In less than five years after they were forced from the trade the commerce had shrunk to less than 12,000,000. Mr. Barchfeld said that the Japs had transformed the Pacific ocean into a Japanese lake and that in case of war with Japan that country could land 200,000 men in our Pacific coast states before the United States could prepare one-tenth that number for battle in the far east. He asserted boldly that our magnificent navy has been turned into a joke because there were no auxiliaries in the shape of colliers, despatch boats, troop ships and scouts.

Hon. James J. Elwell, manager of "American Industries" and the orator assigned by the National Association of Manufacturers for its campaign of education along shipping lines, was the next speaker.

He treated the subject from the viewpoint of the American manufacturer and told how it was that the national manufacturers' association came to realize that their best purposes were subserved in the restoration of the American flag to the high seas. He detailed in a flow of eloquence betokening his southern birth how the manufacturers learned after years of hard knocks that in order to get fair treatment in the shipment of their goods it was necessary to have American ships in which to ship them to foreign ports. He gave instances of mistreatment of shipments and utter disregard of shippers' instructions by foreign ship captains and showed that American goods had often been transferred from ship to ship and taken hundreds, even thousands of miles out of their route in order to harrass the American manufacturer and cause him to lose the sale of goods. He said that Germany was the great commercial rival of the American manufacturer and that German merchants and bankers use every means to dissuade foreign buyers from taking American goods. He cited an instance of a traveling salesman who had sold $10,000 worth of shoes to a Brazilian retail dealer, but lost the order because the town was controlled by German bankers who refused to extend the accommodations necessary to make the trade. The order therefore went to the German, who shipped inferior goods to the buyer. Mr. Elwell's remarks were interrupted at intervals by the applause of the audience as he drove home a strong point in his oratory.

The last speaker was Captain Thomas J. Woodward, a veteran sea captain, of New Orleans, who had in the year 1885 been the first president of the American Shipping League, the first organization effected to aid the American merchant marine. Capt. Woodward's address was largely reminiscent and dealt with the old days of the American clipper ships. He said that when he went to sea the American flag was seen on the Pacific ocean more than any other. American ships lined the docks of every European port and were to be seen in every clime and on every sea. They were the finest in the world in point of speed, workmanship and the character of the officers and men; in fact, they were the envy of every nation. His discourse was interesting to a degree.

The following resolutions were adopted:

WHEREAS, there is an universal demand on the part of the people of the United States of America for the restoration of the American merchant marine; and,

WHEREAS, on March 3, 1891, there was passed by the Congress of the United States, an act authorizing the postmaster general to contract with vessels built in American shipyards, under the supervision of the navy department, and in harmony with navy specifications, and owned and operated by Americans, to carry the American mails and pay therefor, the sum of not more than $4.00 per outgoing mile, said ships to be not less than 8,000 tons capacity, and of not less than 20 knots speed; and,

WHEREAS, said law, which has now been in successful operation from New York, Boston and Philadelphia for nearly 20 years, and to which is directly attributable the operation of the few ocean vessels at present flying the American flag in the foreign trade on the Atlantic ocean, has been entirely restricted to the "short" routes to Mexico, Cuba, Europe, etc., owing to the fact that the greater rate of compensation intended for the "long" routes to South America, China, Australia and the Philippines, and which was incorporated in the original bill, was stricken therefrom by the house of representatives, when said act was passed; and,

WHEREAS, the Humphrey bill, which has recently been reported favorably by the house committee, provided, among other things, that compensation not exceeding $4.00 per mile on routes of 4,000 miles and over, be paid to 5,000-ton vessels of 16 knots speed, built and operated under the government requirements mentioned, thus making possible the operating of said long routes; and,

WHEREAS, said Humphrey bill further provides that the total expense to be incurred in transporting said foreign mail, shall not exceed the revenues derived therefrom; and,

WHEREAS, the said bill also includes a "free ship" provision as a concession to the opinion that a large number of the American people entertain, that this method will remedy existing conditions and likewise includes a differential tonnage tax, also believed by some to be an effective remedy for the up-building of our merchant marine, and the "free ship" feature is such as safe-guards the mail ships and coast-wise service; and,

WHEREAS, the Humphrey bill thus treats respectfully and recognizes the various opinions of our people as to the best way of accomplishing the result which all desire, and offers an opportunity for testing all the methods that have been proposed for this purpose, to the end that, through experience, the really best means may be learned; and,

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WHEREAS, under our present economic system, coupled with the American standard of living, some such provisions as those contained in said Humphrey bill must be adopted by our people, if we are to compete with the subsidized mail ships of foreign countries, with their cheaper-paid, cheaper-fed and cheaper-housed crews; and,

WHEREAS, the restoration of the American merchant marine at the very earliest possible moment is the most vital problem before the American people today, involving, as it does, our prosperity in peace and our security in war:

THEREFORE, be it resolved that we, as delegates to the Gulf States Merchant Marine League in convention assembled, urge upon our senators and representatives in the national congress to support and vote for said measure, which in our opinion is the only practical beginning towards the restoration of our flag to the seas, now largely controlled by vessels of foreign countries, and which would also result in the up-building of a fleet of auxiliary cruisers so indispensable to our needs, in the event of war; and,

BE IT FURTHER RESOLVED, that the time has arrived in the history of our country, when this all-important matter must be considered as a patriotic movement, that we strongly protest against its being made a partisan measure in any sense; and,

BE IT FURTHER RESOLVED, that we vigorously protest against any attempt being made by any caucus, to influence adversely the judgment of our representatives in congress; and,

BE IT FURTHER RESOLVED, that we emphatically protest against the activities of such representatives of foreign shipping interests as are working for the defeat of the Humphrey bill.

(Signed) PETER A. LAWTON,
Chairman Resolution Committee.
C. H. ELLIS.
HORACE TURNER.
H. H. WEFEL JR.
LOUIS P. BRYANT.
HORACE L. PITCHER.

Much interest is being displayed in San Francisco in the revival of American shipping in the oversea trade. Recently Major H. G. Mathewson, technical officer of the Coast Artillery, National Guard of California, set apart a battallion drill in order that the whole of the seven companies might assemble to hear an address on the necessity for a merchant marine to facilitate the rapid movement of troops in case of war.

Capt. John Barneson gave an instructive talk before the California Club on the subject of the merchant marine. After reviewing the decline of our oversea shipping, he said:

"It is plain that the situation must be made clear to all that our present position is a national disgrace and a national danger; that its seriousness cannot be overestimated and that it is the imperative duty of every loyal American to impress upon his representatives and senators in congress the immediate necessity for passing laws that will foster and encourage the upbuilding of the merchant marine at any cost."

The New Orleans Stock Exchange last month adopted the following resolutions in support of the American merchant marine:

"Whereas, the gulf states are vitally interested in the restoration of the American flag to the high seas on account of expected large increase in tonnage from all parts of the world which will come inevitably upon the opening of the Panama canal in 1915, and

"Whereas, this will undoubtedly be such an impetus to commerce as will make the gulf ports the most important in the United States when this long-hoped-for event comes to pass; therefore be it

"Resolved, that the New Orleans Stock Exchange gives its emphatic support to the Humphrey ocean mail bill and urges its representatives in congress to support the passage of the aforesaid bill."

The board of directors of the Business Men's League of Louisiana adopted resolutions last month endorsing the Humphrey shipping bill. Considerable interest in the rehabilitation of the merchant marine has been aroused in New Orleans owing to the stragetic position which it occupies in relation to commerce with South America. At a meeting recently held in the rooms of the Progressive Union, Peter S. Lawton made a stirring address upon the subject.

Alfred Spring, associate justice, Appellate Division, New York supreme court, has an excellent article in the January *Outlook* upon the subject "The Revival of Our Shipping." His preface says:

"There is nothing more justly humiliating for the national pride and nothing more hurtful to the national prosperity than the inferiority of our merchant marine compared with other nations whose general resources, wealth and sea coast lines do not suggest anything for their supremacy on the sea."

He touches upon the decline of our merchant marine since the civil war, on the lack of our facilities in reaching the countries south of us, on the great advances made in our foreign trade relations, and the pitiable decline of our merchant marine in that trade. He urges the establishment of branch banks abroad as an aid to commerce and advocates the passage of the Ocean Mail Bill. His presentation of the case is most forceful throughout.

Bernard N. Baker has an article in the Manufacturers' Record for January on "The Vast Shipping Possibilities of the South." He points to the fact that the 5,000-mile coast line extending from the head of Chesapeake Bay to the mouth of the Rio Grande is the finest in the United States. From Baltimore to Corpus Christi a chain of magnificent harbors invite the traffic of the world. His article is an endeavor to awaken the south to the fact that its location with relation to South America, Central America and the Orient will give it a commanding position when the Panama canal is completed and the trade opportunities of the new markets are opened to its commerce. He shows that in order to reach the Chilian market the Hamburg merchant must ship his goods 3,308 miles further than the Charleston merchant and that the Liverpool mail steamer must sail 3,469 miles further to reach Valparaiso than the mail steamer from Key West. He adds:

"What we want and what the south should be more particularly concerned over is ships to carry away our own products and to bring to our shores such imports as we need for our use. We want American ships. It is no longer disputed that trade follows the flag. I have seen this demonstrated again and again during my long experience as president of an over-sea steamship line. The ship carrying the American flag is a floating advertisement of American enterprise and American goods. Southern people should urge their representatives in congress to consider what it means to the southern industries and southern resources to have direct steamship lines from the great southern ports to the west coast of South America and beyond that to the Orient."

The Manitowoc Boiler Works Co., of Manitowoc, Wis., have just constructed and installed three Scotch marine boilers 12 ft. 6 in. in diameter by 11 ft. long for the new steel passenger steamer Alabama, being built by the Manitowoc Dry Dock Co., for the Goodrich Transit Co., Chicago, Ill. The Manitowoc company are manufacturers of all kinds of heavy plate work and the facilities for handling their products are exceptionally good. The plant is now working a large force of men to take care of the incoming orders.

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THE POWER EQUIPMENT OF A MODERN SHIPYARD.

At a recent meeting of the Liverpool Engineering Society, J. H. Collie read a paper on "The Power Equipment of a Modern Shipyard."

The paper gave a description of the power plant and the distribution and application of power at Cammell Laird & Co.'s new Tranmere works, as affording an example of one of the most modern shipyards. When this power supply was first considered, gas power was making considerable headway and giving results with which no steam plant of moderate size could compare; consequently, it was decided to install gas equipment entirely for furnace heating, electric, pneumatic and hydraulic engines, and so far the decision has been justified by the results. The gas producers are three in number, of 2,000 horsepower each. The plant is very simple in working, and is so designed and constructed that a minimum amount of labor is required for its operation, the gas production being automatically controlled so as to give only the amount required by the gas engines even under variable load. This is regulated by a small gasometer, which acts as a governor, opening the steam valve of the engine driving the draft apparatus when there is a demand for gas and shutting off steam as the demond for gas is reduced. The stand-by losses are also very small. All the engines can be started up at a few minutes' notice, even if the producers have been standing idle for a week or more. The fuel used at present is a mixture of Lancashire gas slack and costs about $2.60 per long ton. As regards cost of production, the average for the four weeks ending Dec. 1 last was 0.64c per unit. During this period there was a night shift running with a light load, which made the cost higher than it would have been for day shift only. The guaranteed coal consumption per indicated horsepower per hour was 1 pound of coal, and the results on trial were slightly better than this. There are at present installed in the power station three generating sets of 250 horsepower and two of 400 horsepower, with a third of 400 horsepower under construction, together with two 260-horsepower air compressing sets and two 80-horsepower hydraulic sets. The 250-horsepower generating sets consist of single-cylinder horizontal positive scavenger engines, coupled direct to 240-kilowatt compound wound generators with a capacity of 500 amperes at 440 volts. The governing is done by varying the quality of gas, and is within 3 per cent from full load to no load. The starting is accomplished by compressed air, which is stored in reservoirs at 200-pound pressure, charged by a motor-driven compressor. The air compressors are of three-crank compound intercooling type, with a capacity of 1,200 cubic feet of air per minute each. They are direct coupled to Westinghouse 260-brake horsepower three-crank vertical gas engines running at 190 revolutions per minute, having cylinders 20-inch diameter by 22-inch stroke. The hydraulic engines are of the three-crank horizontal type, with 3¼-inch plungers, 12-inch stroke, belt-driven from 80-horsepower gas engines.

Electric Power Distribution.

Direct current at 440 volts is used for power, and 220-volt three-wire system for lighting, with separate mains for power and lighting. Compound wound motors are used for most of the shipyard tools, as the heavy flywheels, with which they are fitted, require a considerable amount of power in starting. One rather interesting motor drive is that for the wet basin dock gates. At the 90-foot entrance there are four 20-horsepower series wound motors, driving a worm wheel through friction discs, which transmit the power through a train of gear wheels to the chain drum. The friction discs are set to slip when the motors are overloaded, and this allows the gates to come up to the wall without a jar and without opening the overload circuit breakers, which, when they come into action, throw the controller drums into the neutral position. All four motors are controlled from the same chamber, a special multicore submarine cable being laid across the dock for the motors on the opposite side. A 150-ton revolving crane is fitted with a 110-horsepower motor for hoisting, a 60-horsepower motor for topping-up, and two 12½-horsepower motors in series for slewing. A 40-ton traveling crane has a 50-horsepower motor for hoisting, a 33-horsepower motor for slewing, and a 33-horsepower motor for traveling. The mains from the power station to the shops are 0.6 square inch lead-covered paper concentric cables, drawn into fibre tubes set in concrete, with drawing-in manholes at 100-yard intervals. Spare ducts are provided for future cables. These mains terminate in iron distribution boxes, from which aerial cables with simple double-braided cotton covering, served with preservative compound, supported on insulators well out of reach of any workmen, are run to various groups of machines. The cables from the shipbuilding sheds to the slips are covered with vulcanized bitumen, and are laid on the solid system; these supply a number of cast iron distribution boxes at intervals of 100 feet, from which power and lighting are obtained for ships during construction, and for supplying current to the electric winches on the derricks. In the engine shops the aerial cables are carried on insulators from column to column, and branches are tapped off and run down the columns to cast iron drawing-in boxes and then through galvanized iron piping to the motors. For the supply of power to the Birkenhead Iron Works, which are distant about half a mile from the power station, four aerial aluminum cables are used; these are strained on insulators mounted on post office telegraph poles. As far as possible throughout the works the mains consist of aerial cables carried on insulators.

MARINE ENGINEERS' BENEFICIAL ASSOCIATION ELECTIONS.

No. 1, Buffalo, N. Y.: President, John Bustead; vice president, Carnelius Wild; second vice president, William Garrett; secretary and treasurer, W. D. Blaicher; business manager, W. D. Blaicher.

No. 5, Baltimore Md.: William H. Hyman, president; John D. Tapman, vice president; John Mittendorf, recording secretary; Nicholas S. Harp, corresponding secretary; F. M. Nelson, financial secretary; William J. Kane, treasurer.

No. 6, St. Louis, Mo.: President, Clifford E. Shrodes; vice presidents, George T. Heckmann, Albert M. Jensen; secretary, Frank A. Kremer; treasurer, Charles B. Jackson; chaplain, R. F. McClintock; conductor, Tony J. Costello; doorkeeper, Harry Chandler; trustees, David Duffy, George M. Williams, Charles F. Bottum; representative to national convention, Clifford E. Shrodes; district deputy, William L. Albert.

No. 9, Milwaukee, Wis.: President, William G. Fell; first vice president, Charles W. Moderson; second vice president, Ralph H. Reynolds; treasurer, Joseph R. Mason; financial secretary, William J. McSweeney; corresponding secretary, William L. Bridges; recording secretary, T. J. McSweeney; delegate to national convention, W. L. Bridges; alternate, F. H. Krueger.

No. 13, Philadelphia, Pa.: President, John C. Coote; first vice president, Harvey K. Carter; second vice president, Harry Hartman; financial secretary, Joseph Brooks; recording secretary, R. M. Lodge; corresponding secretary, Robert B. Dick; treasurer, Charles Comer.

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No. 17, Cincinnati, O.: President, Albert Johs; vice president, Melvin

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No. 26, Evansville, Ind.: President, Edgar Easton; secretary and treasurer, T. H. Kirkbride; business manager, Charles Hickman.

No. 30, Pittsburg, Pa.: President, Thomas C. Moore; vice president, John B. Clark; second vice president, Arthur McKay; secretary and treasurer, George E. Ingram; trustees, George C. Boli, John B. Clark, Walter Johnson; chaplain, James A. Wiley; doorkeeper, John K. Shepler; conductor, William French; district deputy, James M. Saunders.

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No. 40, Galveston, Texas: President, Joe B. Hebert; vice president, Harry Anderson; secretary, Richard Ludgate; treasurer, Peter Nelson; chaplain, Charles Anderson; conductor, John Carstens; doorkeeper, Louis B. Davis; trustees, William Prendergast, Richard Cole, Fred Gunderman; delegate to national convention, William Prendergast; business committee, Joe E. Heber, Richard Ludgate, Fred Gunderman.

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No. 63, Albany, N. Y.: President, P. S. Prendergast; first vice president, Peter Deitz; second vice president, Emmett Harding; general secretary, George T. Cahill; treasurer, M. J. Burke; trustees, Joseph D. Roberts, George Van Allen, L. Herrington; delegate to national convention, P. S. Prendergast; alternate, John W. Allardice.

No. 93, Washington, D. C.: President, W. T. King; vice president, W. B. Hayden; recording and corresponding secretary, J. A. Watts; financial secretary, James V. O'Donnell; treasurer, Joseph W. Fox; chaplain, William A. Moore; doorkeeper, Arthur Moore; conductor, G. W. Larsen; trustees, James V. O'Donnell, William Glinn, J. P. Van Ostrand; delegate to national convention, J. A. Watts; alternate, W. B. Hayden.

No. 100, Honolulu, H. I.—President, B. H. Norton; first vice president, C. J. Lynch; second vice president, C. B. Cottrell; treasurer, John M. Sass; financial secretary, Walter H. Bromley; recording and corresponding secretary, H. C. Wootten; conductor, Benjamin Fernbach; chaplain, George Farnsworth; doorkeeper, John Kelly; trustees, J. H. Quinlan, A. V. Inman, Jacob Wagner, James Leach, Daniel Ballew.

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Lodge No. 1, Buffalo, N. Y.: President, Capt. W. H. Stevenson; first vice president, Capt. James G. Herbert; second vice president, Capt. Dave Curran; treasurer, Capt. John B. Hall; secretary, Capt. Charles McMillan; marshal, Capt. Dan Caughlan; chaplain, Capt. Jerry Coleman; warden, Capt. Harry Warwick; sentinel, Capt. P. O'Neil.

Lodge No. 2, Port Huron, Mich.: President, Capt. H. Maitland; first vice president, Capt. F. W. Manual; second vice president, Capt. Tyler Crockett; treasurer, Capt. D. M. Sinclair; secretary, Capt. J. H. Sinclair; delegate to grand lodge, Capt. J. H. Sinclair.

Lodge No. 3, Chicago, Ill.: President, Capt. John Jenks; vice president, Capt. W. T. Bright; second vice-president, Capt. Thomas B. Minter; treasurer, Capt. William W. Shaw; secretary, Capt. F. B. Higgie; delegate to grand lodge, Capt. W. D. Hamilton; alternate, Capt. John Jenks.

Lodge No. 4, Cleveland, O.: President, Capt. Charles A. Benham; first vice president, Capt. George Holdridge; second vice president, Capt. George McGarry; treasurer, Capt. F. L. Leckie; secretary, Capt. J. A. Holmes; delegate to grand lodge, Capt. Charles Benham; alternate, Capt. George Holdridge.

Lodge No. 6, Milwaukee: Capt. Charles F. Bronson, president; H. M. Boyce, vice president; Thomas Garrity, second vice president; John McSweeney, secretary; F. C. Maxon, treasurer; William Jamieson, chaplain; John A. Doak, marshal; Joseph A. Brownell, warden; Harry Bennet, sentinel.

Lodge No. 7, Detroit, Mich.: President, Capt. B. S. Baker; first vice president, Capt. Alex. Clark; second vice president, Capt. William H. Hoffman; treasurer, Capt. T. Lemay; secretary, Capt. C. G. Merckel; marshal, Capt. Charles Autterson; chaplain, Capt. L. Ludington; warden, Capt. A. A. Archer; sentinel, Capt. George Talbot; delegate to grand lodge, Capt. F. J. Simpson; alternate, Capt. W. H. Hoffman.

Lodge No. 8, Marine City: Capt. James H. McDonald, president; R. Z. Utley, first vice president; P. L. Williamson, second vice president; James Taylor, treasurer; J. E. Cottrell, financial secretary; W. M. Hetherington, recording secretary; William T. Young, chaplain; G. Graves, marshal; O. Fehmer, warden; D. Mitchell, sentinel.

Lodge No. 9, Toledo, O.: President, Capt. N. M. Sullivan; first vice president, Capt. J. B. Warner; second vice president, Capt. H. N. Jex; secretary and treasurer, Capt. E. G. Ashley; chaplain, Capt. James McKinley; marshal, Capt. George V. Sage; warden, Capt. John Cunningham; sentinel, Capt. Otto Rose.

Lodge No. 10, Ogdensburg, N. Y.: President, Capt. M. A. Leonard; first vice president, Capt. Fred Loveless; second vice president, Capt. Eugene Dubrule; treasurer, Capt. Henry Russell; financial secretary, Capt. H. A. Murphy; chaplain, Capt. William Stitt; warden, Capt. A. C. Nelson; marshal, Capt. Fred Gamash.

Lodge No. 11, Algonac, Mich.: President, Capt. M. M. Stewart; first vice president, Capt. James P. Stewart; second vice president, Capt. F. D. Galton; treasurer, Capt. D. A. Kendall; secretary, Capt. F. R. Hemenger; chaplain, Capt. N. T. Little; marshal, Capt. Theodore Grant; warden, Capt. Samuel Kenworthy; sentinel, Capt. James Brines; delegate to grand lodge, Capt. M. M. Stewart; alternate, Capt. R. C. Jackson.

Marvin Hughitt, president of the Chicago & Northwestern, and Albert J. Earling, president of the Chicago, Milwaukee & St. Paul railroad, express the belief that the municipal dock and terminal projected under preparation by the city of Milwaukee is most desirable and that they will do their utmost to promote it.

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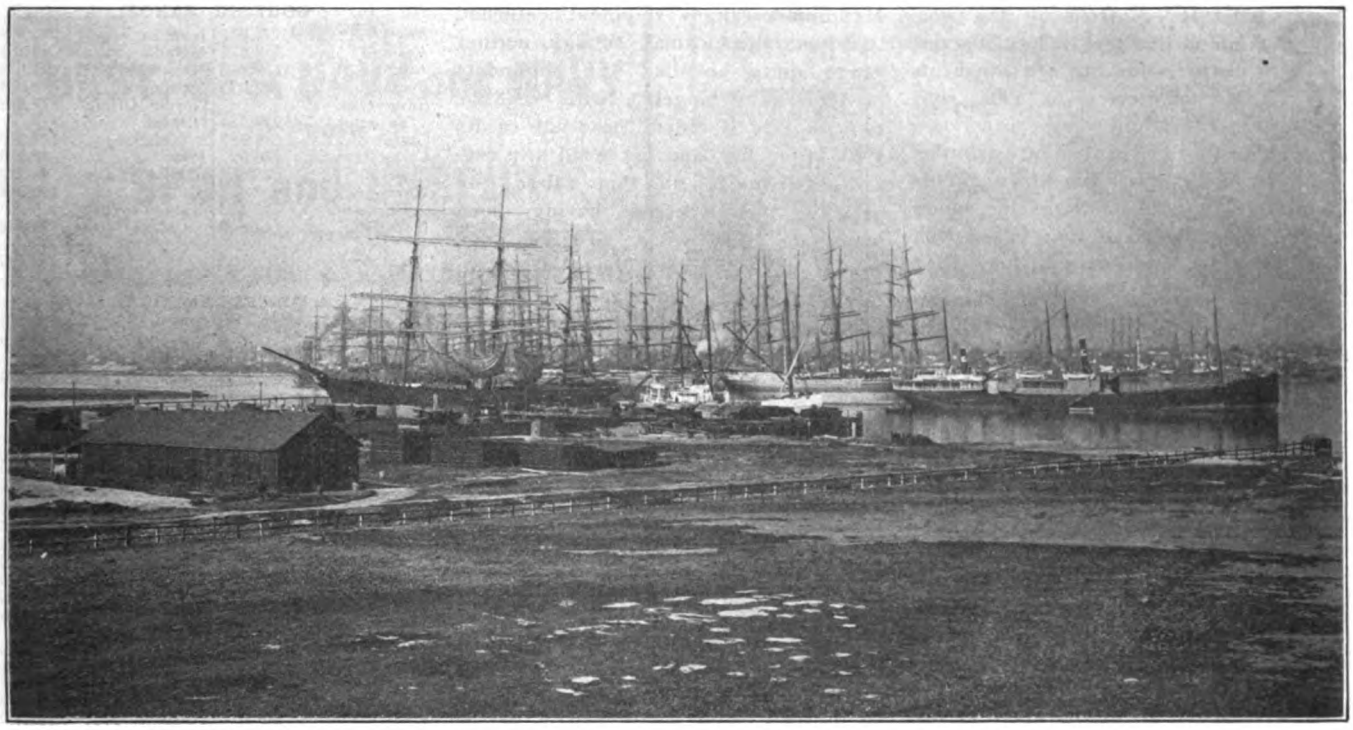
FOREIGN SHIPS IN THE SAN FRANCISCO GRAIN TRADE.

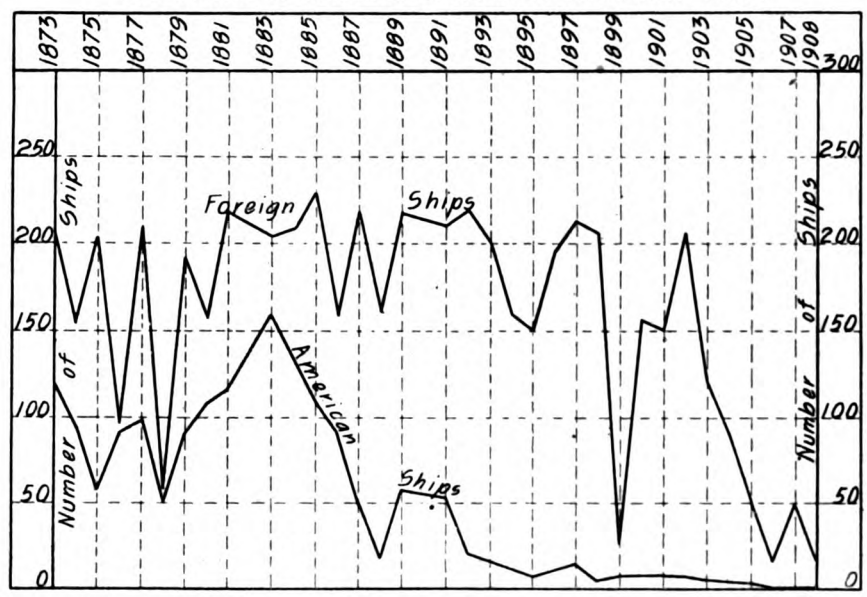
The havoc which recent years have wrought in America's foreign shipping on the Pacific coast is graphically illustrated by the accompanying diagram and photograph. The diagram shows the number of American and foreign ships engaged in the grain trade from the port of San Francisco for a period of 35 years from 1873 to 1909. The diagram was compiled from statistics furnished by the Merchants' Exchange of San Francisco. The steady decline of American shipping from 1883 when 169 American vessels were engaged in this commerce down to 1906, when the last ship flying the stars and stripes had been driven out of the business, is plainly shown. The foreign shipping interests, aided by liberal subsidies, granted by their own governments, finally got a strangle hold on the American ships in 1905 and since that year have enjoyed a monopoly of the grain business of San Francisco. The number of foreign ships engaged in the trade shows violent fluctuations, but always, throughout the entire 35 years, the foreigners were ahead. The nearest the American vessels came to equalling their foreign rivals was in 1878, when there were 50 American and 59 foreign ships employed; the greatest discrepancy is exhibited in 1907, in this year only 24 American ships were used, while the foreign bottoms numbered 226. Of late years the total grain movement of the port has greatly declined and in face of this decreasing market the American ships, devoid of government aid, were unable to hold out. As a result, the foreigners enjoyed the little revival in business during 1907 entirely without molestation.

The photograph shows the great fleet of American ships rotting away in Oakland harbor, San Francisco bay. The writer counted 46 of these vessels in one fleet, including eight steamers. Many of them are the identical vessels that have been driven out of the grain business by foreign subsidized competition. In the fleet illustrated are some of the ships belonging to the Alaska Packers' Association, formerly engaged in the foreign trade, but now finding employment only for a part of each year carrying canned salmon from Alaska to San Francisco. A view of the forest of idle masts in Oakland harbor is about as disconsolate a sight as an American cares to witness.



AMERICAN VESSELS ROTTING AWAY AT ANCHOR IN OAKLAND HARBOR, SAN FRANCISCO.

THE DECLINE OF AMERICAN SHIPPING ON THE PACIFIC COAST.



CURVE SHOWING NUMBER OF AMERICAN AND FOREIGN SHIPS ENGAGED IN THE EUROPEAN GRAIN TRADE FROM SAN FRANCISCO FOR THE PAST THIRTY-FIVE YEARS.

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Iron Ore Shipments by Mines and Ranges During 1909

RETURNS from all the iron mines in the Lake Superior district, showing ore shipments for the season of 1909, with comparisons for previous years, are presented in a supplement to this issue, compiled by *The Iron Trade Review*. The table includes the mines in the Mayville district in Wisconsin, and shows that there was forwarded by lake and rail 42,586,869 tons of ore, of which 41,683,599 tons were shipped by lake and 903,270 tons by rail. This total for the lake shipments does not include 170,065 tons shipped from the Helen mine for the Lake Superior Corporation at Michipicoten.

The total for the year was the highest ever reached in any season on the Lake Superior ranges, being greater than the shipments for 1907, the previous record year, by 320,201 tons. The lake shipments for the year were greater than those of 1907 by 394,844 tons. These figures are about those that were expected at the close of the season. The comparisons with 1908 are, of course, vastly in favor of the year just passed, as the depression in 1908 caused a falling off of shipments for that year to 26,014,987 tons, which it will be noticed is considerably less than the 1909 shipments from the Mesabi range alone, but the comparisons are interesting, nevertheless, as illustrating the marvelous capacity of the Lake Superior ranges for responding to the demands of the iron trade. The difference in favor of 1909 is 16,571,882 tons, and this excess alone is greater than the total shipments of all the ranges 12 years ago. The increase in the 1909 shipments amounted to about 64 per cent of the shipments in 1908. The Marquette and Menominee ranges' shipments returned to about the normal, though neither range quite equalled the shipments in 1907. The Gogebic, with 4,088,057 tons, nearly doubled the total of its 1908 shipments, and exceeded any record ever made on that range, the previous high record having been made in 1905, when 3,705,207 tons were sent down. The Vermillion range made a good gain over the 1908 shipments, but did not reach its normal, nor did it equal its shipments in any year between 1896 and 1907. This comparatively poor showing from the Vermillion was not due to any failure in the mines, as much larger shipments could have easily been made had the Steel Corporation seen fit to work the mines to their capacity.

An examination of the table will show that all of the gains in 1909 over 1907 were contributed by the Go-

Shipments by Mines.

MESABI RANGE.

Adams	1,829,372	La Rue	365,543
Adriatic	107,317	Laura	178,110
Agnew	151,536	Lectonia	553,162
Albany	368,057	Leonard	6,857
Bessemer	227,767	Lincoln	303,066
Biwabik	542,821	McKinley	89,981
Bray	65,514	Mahoning	1,561,893
Brunt	14,212	Malta	92,356
Burt	1,660,101	Mariska	77,690
Canisteo	85,505	Miller	277,119
Chisholm	314,597	Minorca	119,154
Cincinnati	4,537	Mohawk	216,291
Clark	484,512	Monica	7,614
Commodore	409,148	Monroe	147,521
Corsica	135,366	Morris	1,831,187
Crosby	183,470	Myers	193,698
Croxton	159,038	Nassau	11,940
Cyprus	107,685	Onandaga	59,389
Duluth	150,501	Pearson	68,683
Elba	224,202	Perkins	59,029
Euclid	82,627	Pettit	83,548
Fayal	1,879,357	Sellers	626,169
Forest	6,304	Seville	23,585
Fowler	99,892	Shenango	831,099
Franklin	51,393	Sliver	256,073
Gilbert	783,683	Spruce (Cloquet)	579,903
Glen	396,591	Stevenson	1,030,742
Hanna	238,873	Susquehanna	243,049
Hawkins	316,783	Syracuse	5,509
Hector (Hale)	30,726	Tener	256,384
Higgins No. 2	322,504	Troy	86,520
Holman	391,157	Utica	201,480
Hull-Rust	3,039,911	Victoria	113,305
Iroquois	152,510	Virginia (Group)	1,843,450
Jennings	10,477	Wacoutah	60,966
Jordan	12,754	Wills	3,449
Kellogg	165,458	Winnifred (Day)	84,614
Kinney	287,421	Yates	5,362
Knox	7,464	Yawkey	45,790
La Belle	27,216		
Larkin (Tesora)	46,651		
Total			28,176,281

GOGEBIC RANGE.

Anvil	22,927	Ironton	277,594
Ashland	259,612	Mikado	99,195
Atlantic	124,845	Montreal	191,611
Brotherton	103,090	Newport	1,008,354
Cary (and Superior)	224,251	Norrie Group	977,054
Castile	26,982	Ottawa (Odanah)	100,223
Colby	170,095	Pike	22,174
Eureka	115,662	Sunday Lake	93,712
Harmony (Germania)	152	Tilden	154,506
Iron Belt	44,560	Yale (West Colby)	71,458
Total			4,088,057

MISCELLANEOUS. (In Wisconsin.)

Iron Ridge	15,955	Mayville	66,804
Total			82,759

MENOMINEE RANGE.

Aragon	246,984	Great Western	112,747
Baker	45,003	Groveland	24,933
Baltic	174,426	Hemlock	112,481
Berkshire	34,295	Hiawatha	136,739
Bristol (Claire)	396,825	Hollister	25,842
Caspian	189,023	James	90,851
Chapin (Ludington)	587,647	Lincoln	1,657
Chatham	68,730	Loretto	96,613
Clifford	103,626	Mansfield	118,713
Commonwealth	50,787	McDonald	1,144
Crystal Falls	986	Millie (Hewitt)	10,887
Cundy (Quinnesec)	5,512	Munro	23,241
Doher (Riverton)	171,200	Penn Iron M'ng. Co.	428,004
Dunn	193,396	Pewabic	465,453
Florence	231,191	Quinnesec	3,147
Fogarty	77,356	Saginaw (Perkins)	19,994
Genesee (Ethel)	65,585	Tobin	359,668
Gibson	36,246	Youngs	154,150
		Zimmerman	10,303
Total			4,875,385

MARQUETTE RANGE.

American (Sterling)	90,001	Lillie	61,708
Austin	125,858	Lucy (McComber)	1,672
Beaufort (Ohio)	72,987	Maas	159,197
Breitung Hem. No. 2	129,673	Mary Charlotte	240,433
Cambria	136,815	Negaunee	312,217
Champion	11,199	Portland	79,652
Cleve'd-Cliffs Group	877,433	Princeton (Sw'nz'y)	42,934
Empire	108,993	Queen (Blue)	237,509
Hartford	250,680	Republic	176,575
Imperial	115,478	Richmond	102,566
Jackson	11,060	Rolling Mill	133,139
Lake Ange'ine	280,298	Stegmiller	39,869
Lake Superior	349,435	Stephenson	64,075
		Washington	44,716
Total			4,256,172

VERMILLION RANGE.

Pioneer	477,226	Soudan (Minnesota)	74,862
Savoy	83,167	Zenith	321,951
Sibley	151,009		
Total			1,108,215
Grand Total			42,586,869

SHIPMENTS BY RANGES, GROSS TONS.

	1909	1908	1907	1906	1905	1904
Marquette range	4,256,172	2,414,632	4,388,073	4,057,187	4,215,572	2,843,703
Menominee range	4,875,385	2,679,156	4,964,728	5,109,088	4,495,451	3,074,848
Gogebic range	4,088,057	2,699,856	3,637,102	3,643,514	3,705,207	2,398,287
Vermillion rangs	1,108,215	841,544	1,685,267	1,792,355	1,677,186	1,282,513
Mesabi range	28,176,281	17,257,350	27,495,708	23,819,029	20,158,699	12,156,008
Miscellaneous	82,759	122,449	95,790	144,589	132,001	94,042
Total	42,586,869	26,014,987	42,266,668	38,565,762	34,384,116	21,849,401

SHIPMENTS BY PORTS AND ALL-RAIL, GROSS TONS.

	1909	1908	1907	1906	1905	1904
Escanaba	5,747,801	3,351,502	5,761,988	5,851,050	5,307,938	3,644,267
Marquette	2,909,451	1,487,487	3,013,826	2,791,033	2,977,828	1,907,301
Ashland	3,834,207	2,513,670	3,436,867	3,388,106	3,485,344	2,288,400
Two Harbors	9,181,132	5,702,237	8,188,906	8,180,125	7,779,850	4,566,542
Gladstone						553
Superior	6,540,505	3,564,030	7,440,386	6,083,057	5,118,385	4,169,990
Duluth	13,470,503	8,808,168	13,448,736	11,220,218	8,807,559	4,649,611
Total by lake	41,683,599	25,427,094	41,288,755	37,513,589	33,476,904	21,226,664
Total by rail	903,270	587,893	975,959	1,052,173	907,212	622,737
Total	42,586,869	26,014,987	42,266,668	38,565,762	34,384,116	21,849,401

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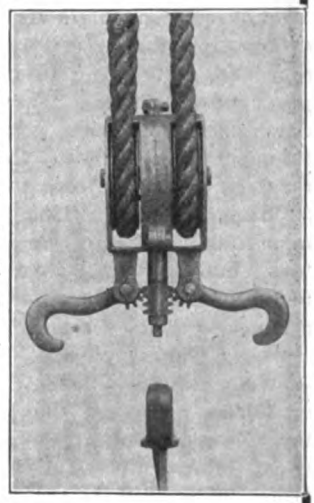

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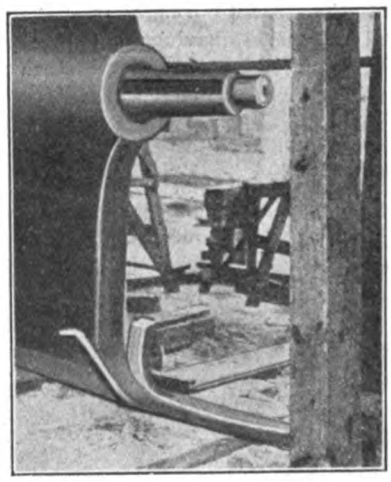

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gebic and Mesabi ranges. On the Mesabi, after the season was once fairly under way, shipments proceeded with great activity, with the result that the 1908 record was exceeded by over 10,000,000 tons, and the 1907 record by about 800,000 tons. As was to be expected, the United States Steel Corporation was by all odds the largest shipper from the range, but it did not quite maintain its former position. In other years, the Corporation has sent down as much as 56 per cent of all the shipments from the ranges, but this year its total shipments are only a trifle greater than 50 per cent, or, to be exact, 50.36 per cent. In 1908, only three mines shipped more than 1,000,000 tons, but in 1909, nine mines are found in this exclusive circle of big producers. They are the Adams, Burt, Fayal, Hull-Rust, Mahoning, Morris, Stevenson and the Virginia or Oliver group on the Mesabi, and the Newport on the Gogebic. Of these mines, the Hull-Rust is the leader, with 3,039,911 tons, being more than a million tons ahead of its closest rival, and eclipsing all previous records for any iron mine on the Lake Superior ranges, and doubtless for any mine in the world. During the season the Fayal mine took the leadership of the Mesabi range in point of total shipments, having sent down at the end of the season a total of 18,132,550 tons, passing the record of the Mountain iron mine, which was 17,198,871 tons. This change in the relative positions of the mines is made possible by the shut-down of the Mountain Iron, from which no shipments were made during 1909, and only a very small shipment in 1908. The Mountain Iron is by no means worked out, but active work there has been discontinued for business reasons. The total shipments of the Fayal do not equal the totals of two of the old range mines or groups, but the much greater periods over which the old range mines have been operated make the Mesabi totals considerably more significant.

A number of new properties appear on the table this year. Among the new mines are the Syracuse, Pearson, Euclid, Perkins and Bray on the Mesabi range; McDonald on the Menominee, and the Stegmiller on the Marquette. This latter mine is a property of the Steel Corporation, which for some unaccountable reason, has been spoken of in recent publications as the Brotherton, but it has no connection with the famous Brotherton mine on the Gogebic range. All of the figures given in the total were compiled from original sources, and verified and corrected by comparison with the figures supplied by all railroads handling ore in the iron regions.

HERE'S ANOTHER.

On board U. S. Steamer (******).
Jan. 8, 1910.

Editor MARINE REVIEW:

I am sending remittance herewith, and take the opportunity to say that I greatly appreciate your good work, especially on the Naval Waste and on the subsidy question.

I wish someone could write up the folly of the Government building and maintaining colliers. One-tenth of the cost per year in the form of a subsidy would cause many ships to be built which would always be ready and which would add to the national wealth. You will, of course, not use my name.

Wishing you all success for the new year, I am,

Yours faithfully,

* * * * * * *

Address Bureau Construction & Repair, Navy Department, Washington, D. C.

FIGHT ON PACIFIC MAIL LINE STARTS.

The J. L. Luckenbach, of the Luckenbach Steamship Co., of New York, has been chartered to run in opposition to the Pacific Mail Steamship Co., on the Pacific coast. There is also a possibility of the Lewis Luckenbach, of the same fleet, being fixed for the same trade between San Francisco and Panama. The steamship company, which will oppose the Pacific Mail on the Southern route, is made up of several well known western capitalists, who are for the present reserving their identity. The representative of the company recently made an attempt to charter the Lyra, of the Boston Tow Boat Co., but thus far there has been no successful culmination to the negotiations. The Lyra is at present operating on the Atlantic coast, after taking cargo from the Pacific coast, where she formerly operated. She is an excellent freighter and is in considerable demand at present in Pacific waters. There is a rumor that the Matson Navigation Co., of San Francisco, recent purchasers of the Hyades from the Boston Tow Boat Co., are negotiating with the owners for the purchase of the Lyra and Pleiades for the Hawaiian trade. No confirmation of this report can be obtained.

The J. L. Luckenbach, carrying the largest single shipment of shingles ever made from Puget Sound to the East, numbering more than 3,000,000, will be turned around and sent back to the west coast upon her arrival at New York. Some interesting developments are then anticipated on the southern run where the Pacific Mail is strongly entrenched. It is said there will be a hot fight for the trade started as soon as the Luckenbach, which is on time charter, arrives at San Francisco from the East.

MODERN PASSENGER DOCK FOR TACOMA.

Tacoma, Wash., is soon to have an up-to-date exclusively passenger dock. The new dock will be built by the Commercial Dock Co., of Tacoma, and will be erected on Northern Pacific property, just north of the company's present warehouse. The plans are awaiting final approval by officials of the railroad. It is hoped to have the pier ready for use in May. The plans call for a two-story building, 75 ft. wide and 100 ft. in length. It will connect with the present overhead bridge leading to the property. On the upper floor will be located the ticket offices and comfortable waiting rooms, while the ground floor will be devoted to the baggage rooms. Dining rooms and other accessories will be given accommodation. Along the north and east sides will extend a balcony. There will be two slips, each 12 ft. in width. On the outer side the larger steamers will berth, while the local vessels will dock at the inside slip. A movable walk adjusted to the stage of the tide will lead to the steamers. It is expected that the steamers Flyer, Indianapolis, Greyhound and all the local passenger craft will use this pier. It will shorten the distance from the steamer landings to the city, which is an advantage, and will also provide an overhead crossing over the railroad tracks, for which there has long been an insistent demand.

The William Cramp & Sons Ship & Engine Building Co., Philadelphia, has just issued a book giving a history of its great shipyard. The book contains a brief history of the yard, but is principally made up of illustrations of the various vessels that it has built, beginning with the clipper ship Morning Light and ending with the Momus. Included also are illustrations of the engines and pumps which it has built. Everything about the book bespeaks workmanship of the highest order. It is beautifully bound in green leather.

The Marine Engineers' Beneficial Association of Honolulu has adopted resolutions opposing the suspension of the coastwise shipping laws to Hawaii.

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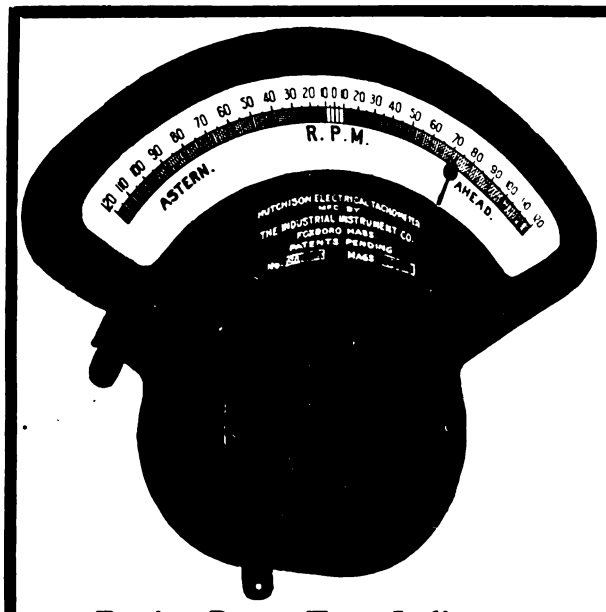

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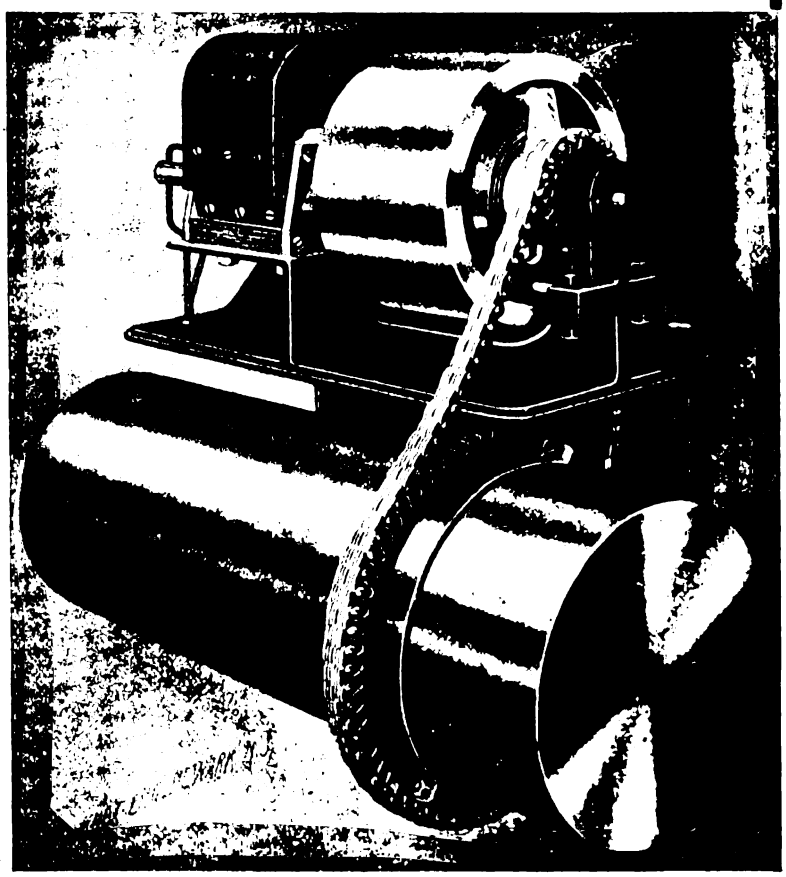

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COMMERCE OF DULUTH-SUPERIOR HARBOR.

Lieut. Col. Graham D. Fitch, corps of engineers, United States army, in charge of the harbors of Lake Superior, has just made public his report of the commerce of Duluth and Superior harbors for the calendar year 1909.

The increase in freight tonnage for these two ports during the past year was 39.69 per cent. Iron ore shows an increase of 8,414,006 tons over 1908, with an increase in valuation amounting to $24,969,396. Hard coal shows an increase of 96,553 tons over 1908, with an increase in valuation amounting to $603,457. Soft coal shows a decrease of 239,549 tons under 1908, with a decrease in valuation of $540,290. Wheat and other grains show a decrease of 2,586,313 bushels under 1908, with a decrease in valuation of $1,010,897. Flour also shows a decrease of 128,569 barrels under 1908, with an increase in valuation of $639,235, and general merchandise shows an increase of 3,174 tons and $587,193 over 1908. Lumber shows an increase of 73,054,000 ft. and an increase in valuation amounting to $1,875,118 over 1908. The total number of passengers arriving and departing was 51,423.

The navigation season covered a period of 250 days. This is reckoned from the first departure or arrival to the last departure or arrival to or from the lower lakes. The open season for Duluth-Superior harbor to and from Lake Superior ports only, was much longer, as some local boats ran all but two months of the year.

The first departure for lower lakes was on April 17, and the last departure for the lower lakes was on Dec. 10. The first arrival from the lower lakes was on April 28, and the last arrival from the lower lakes was on Dec. 22. North shore boats were running at close of calendar year.

The total receipts of cargo for Duluth and Superior combined totalled 6,815,410 tons, with a value of $75,504,761, while shipments amounted to 25,713,891 tons, valued at $136,604,398

PILOT CHART OF THE GREAT LAKES.

The new pilot chart of the great lakes just issued by the Hydrographic Office is full of interesting information. It illustrates the wide and useful field of work in which that branch of the government service is engaged. Not content with notifying lake navigators of all changes affecting navigation, by means of weekly notices to mariners, the hydrographic office makes use of its pilot chart to convey valuable information, outside the scope of the notices to mariners.

The present edition is devoted largely to treating the question of local magnetic attraction, showing the points on the great lakes where it is found, and the dangerous effect it has on the compass, leading vessels ashore.

The hydrographic office desires to encourage the use of the pelorus for the safety of the ship. Tables are given on this chart showing the corrections to be applied in working the pelorus. The equation of time for 1910 is given for every day during the year, and the correction to be applied to Standard time to obtain local mean time is given for every half minute.

Changes in deviation due to change from light to loaded with coal and ore are shown. The result of experiments made last summer by the hydrographic office with a typical ore carrier is given, together with a curve showing the deviations under all conditions. The distances between 119 ports on the great lakes have been computed by the hydrographic office, making a total of nearly 14,000 distances, all of which are tabulated in convenient form on the pilot chart, so that the distance between any two ports can be seen at a glance.

The office also takes a great deal of interest in the strandings which occur on the lakes, and has marked off on the chart the place where each of the 208 strandings of the year 1909 occurred.

ORE SHIPMENTS TO LAKE MICHIGAN PORTS.

Shipments of ore to Lake Michigan ports during 1909 were as follows:

	Tons.
Escanaba	1,306,510
Ashland	354,527
Superior	978,463
Duluth	3,023,033
Two Harbors	1,226,235
Marquette	87,574
Total	6,973,342

LAKE PASSENGER TRAFFIC.

Statistics of passengers carried on the great lakes during 1909 as compiled by the Steamboat Inspection Service are as follows:

Fifth district	381,672
Eighth district	11,556,558
Ninth district	3,191,695

TOWBOAT HUNTER BURNED.

The towboat, Hunter No. 2, after nearly 50 years of eventful life, was burned March 7 near Dravosburg, above Pittsburg, while under full head of steam going up the Monongahela river. The double crew of fourteen men and captain escaped. The Hunter No. 2 was built in 1863 and has been practically rebuilt several times. She was valued at $15,000 and was fully insured. She was owned by the Diamond Coal & Coke Co. and was towing five barges and three floats, all empty, to the coal mines at Courtney, when the fire occurred. William Cavet, the day pilot, said that the mud drum or a rivet had blown out, and escaping steam, shooting into the furnace, blew the fire out over the boat. The whole forepart of the boat was in flames when the fire was discovered.

LAKE LAUNCHINGS.

The bulk freighter John B. Cowle, building for the United States Transportation Co., was launched from the Lorain yard of the American Ship Building Co., on Saturday, March 5; the bulk freighter Harry Yates, building for Boland & Cornelius, of Buffalo, was launched at the St. Clair yard of the Great Lakes Engineering Works, on March 5; the excursion steamer Canadiana, building for the Crystal Beach service of the Lake Erie Excursion Co., was launched from the Buffalo yard of the American Ship Building Co., on March 5.

The bulk freighter Champlain, building for the Northern Lakes Steamship Co., was launched from the Ecorse yard of the Great Lakes Engineering Works, on March 4.

OBITUARY.

Peter Lynch, for 20 years harbormaster at Cleveland, died at St. Alexis Hospital on Wednesday, March 9. He was born in Dublin 64 years ago and no man was better known along the whole chain of lakes.

The generating set of the Seattle fireboat, described in this issue, was manufactured by the B. F. Sturtevant Co., Hyde Park, Mass.

On March 1 Alexander Backus disposed of his holdings in the Vulcan Steam Shovel Co., Toledo, to H. P. Eels and G. F. Steedman, of the Bucyrus Co.

U. S. ENGINEER OFFICE, DULUTH, Minn., February 24, 1910. Sealed proposals for furnishing 10,000 barrels of American Portland cement for Superior Entry, Wis., will be received here until noon, Thursday, March 24, 1910, and then publicly opened. Information on application. Graham D. Fitch, Lt. Col. Engrs.

SAND SUCKER FOR SALE. CAPACITY 250 yards. Boat rebuilt 1909. Has Morris 10" direct connected pumphose handled by steam hoist and all equipment is modern and complete. Apply 910 American Trust Bldg., Cleveland, Ohio.

TUG "JOHN LEATHEM" FOR SALE, steam screw, length 80 ft., beam 17 ft., depth 8.5 ft., F. & A. Engine 14 x 28 x 26. Marine Fire Box Boiler 16 ft. x 75 in. diam., steam steerer. Completely equipped for heavy towing work. Facilities for double crew. Good condition. Address 17 Commercial Bank Bldg., Cleveland, Ohio.

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